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ABSTRACT

One of four individualized courses included in a radio and television repair curriculum, this course focuses on diagnosing difficulties, making necessary adjustments, and removing and replacing components for a radio receiver. The course is comprised of seven units: (1) Introduction to Radio, (2) Crystal Detectors, (3) Regenerative Receivers, (4) The Radio Power Supply Section, (5) The Radio-Audio Section, (6) The Radio RF Section, and (7) Superheterodyne Receivers. Each unit begins with a Unit Learning Experience Guide that gives directions for unit completion. The remainder of each unit consists of Learning Activity Packages (LAP) that provide specific information for completion of a learning activity. Each LAP is comprised of the following parts: objective, evaluation procedure, resources, procedure, supplemental sheets, study guide, and a LAP test with answers. The course is preceded by a pretest which is designed to direct the student to units and performance activities. (LRA)

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ED197189

MOUNTAIN PLAINS LEARNING EXPERIENCE GUIDE:
Radio and T.V. Repair.

Course: Basic Radio Theory & Component Assembly.

CE 027 819

U S DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
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Date Published: 11/12/75

Mountain-Plains Education &
Economic Development
Program, Inc.

Glasgow AFB, Montana 59231

Learning Experience Guide

COURSE: BASIC RADIO THEORY & COMPONENT ASSEMBLY

DESCRIPTION:

This Course is planned to give you basic radio theory. In addition, you assemble radio components to build a radio receiver.

Operational characteristics of circuits used in radio receivers are described. Electronic test equipment is used to evaluate the radio circuits and circuit components that you build. Alignment procedures for radio receiver sections are presented and practiced.

RATIONALE:

The radio service person is expected to diagnose, troubleshoot, align and repair radio receivers. Effective diagnosis requires a service person to understand the functions and operational characteristics of circuits. To troubleshoot requires knowledge about the functions and operational characteristics of circuit components. In order for a radio receiver to transfer signals from one section to another, it must be properly aligned. When a radio circuit component fails, the service person is required to locate and correct it.

PREREQUISITES:

Course: AC Circuits

OBJECTIVES:

Given text/workbook, tools and equipment, student will diagnose difficulties, make necessary adjustments, remove and replace components for a radio receiver to make it function according to manufacturer's standards.

RESOURCES:

A resource list is attached.

GENERAL INSTRUCTIONS:

This Course has seven units. Each unit has a Unit Learning Experience Guide (LEG) that gives directions for unit completion. Each unit consists of Learning Activity Packages (LAPs) that provide specific information for completion of a learning activity. Pretesting results direct the student to units and performance activities.

Principal Author(s): B. Vetter

GENERAL INSTRUCTIONS CONT.:

The general procedure for this course is as follows:

(1) Read the assigned unit LEG for this course.
(2) Begin and complete the first assigned LAP.
  a. Take and score the LAP test.
  b. Turn in the LAP test answer sheet.
  c. Determine the reason for any missed items on the LAP test.
  d. Proceed to the next assigned LAP in the unit.
  e. Complete all required LAPs for the unit by following steps (a) through (d).
(3) Take the unit tests as described in the Unit LEG "Evaluation Procedures".
(4) Proceed to the next assigned unit in this course.
(5) Follow steps 1 through 4 for all required units for this course.
(6) Proceed to the next assigned course.

You will work independently unless directed to do otherwise. When questions or problems arise, you are expected to discuss them with the instructor. At all times remember to follow correct safety procedures during the performance activity.

PERFORMANCE ACTIVITIES:

.01 Introduction to Radio
.02 Crystal Detectors
.03 Regenerative Receivers
.04 The Radio Power Supply Section
.05 The Radio-Audio Section
.06 The Radio RF Section
.07 Superheterodyne Receivers

EVALUATION PROCEDURE:

Course evaluation is by pre and post testing using a multiple-choice type of test.

In this course, the course test is used as a pretest to determine which units, if any, the student may be able to validate. The student is considered validated for a particular unit if 4 out of 5 items are correctly answered for each LAP part on the course pretest and that particular unit does not have a performance test requirement.

For those units with performance test requirements, the student must also satisfactorily complete the performance test to validate that unit. Unit performance test validation procedures are given in the "Evaluation Procedure" section of the unit Learning Experience Guide (LEG).

The course test will also be taken by the student as a post test to determine any changes resulting from taking all or part of the course.

FOLLOW-THROUGH:

After completing this guide, obtain the Unit LEG for 77.03.01., Introduction to Radio.

Basic Radio Theory & Component Assembly 77.03

Printed Materials

1. Basic Radio, Parts 1 & 2. Heath Company, Benton Harbor, Michigan, 1960.
2. Electronics Assembly and Fabrication Methods. Duarte and Duarte, McGraw-Hill Book Company, 1973.

Audio/Visuals

none

Equipment

1. Alignment tool set.
2. Basic Radio Kit, Heathkit Model EK-2, Heathkit Company, Benton Harbor, Michigan.
3. Desoldering iron.
4. Drill bits.
5. Drill, power.
6. Ladder, step (6 ft.)
7. RF signal generator.
8. Soldering iron.
9. Soldering tools.
10. Tools, hand: (Service Master Kit 99SM or equivalent - Xcelite 99SM Kit, Jensen Tools and Alloys, 4117 North 44th Street, Phoenix, Arizona.)

    tool bag
    crescent, 6" (no. 46-C)
    cutters, side (55 CG)
    extension, X10
    hole reamer (no. 38 and 39)
    nut driver handle (99-1)
    nut driver shaft (3/16, 7/32, 1/4, 9/32, 5/16, 11/32, 3/8, 7/16, and 1/2 inch)
    pliers, needle nose (52 CG)
    screw driver, flat blade (811 and 250)
    screw driver, Phillips (821)
    STB handle (99-3)
    STB shaft (1/4, 5/16, and 3/8 inch)
11. Vacuum tube volt meter.
12. Volt-ohm meter.

6/24/75

COURSE TEST ANSWER SHEET

Occupational Area: PRE & POST
File Code: 77.03.00.00 A2~~2~~
Name: ____________
Family Pay Number ____________ Sex M F (Circle 1)

ANSWERS

77.03.01.01
1. D ____
2. D ____
3. A ____
4. D ____
5. D ____

02
6. A ____
7. A ____
8. A ____
9. A ____
10. A ____

03
11. B ____
12. C ____
13. D ____
14. C ____
15. D ____

04
16. B ____
17. D ____
18. C ____
19. A
20. D

77.03.02.01
21. A ____
22. A ____
23. D ____
24. D ____
25. D ____

02
26. B ____
27. A ____
28. C ____
29. B ____
30. B ____

03
31. B ____
32. A ____
33. D ____
34. D ____
35. D ____

04
36. B ____
37. A ____
38. D
39. A
40. D

05
41. A ____
42. D ____
43. B ____
44. D ____
45. D ____

06
46. C ____
47. C ____
48. A ____
49. B ____
50. D ____

07
51. D ____
52. B ____
53. B ____
54. D ____
55. A ____

08
56. D ____
57. B ____
58. A
59. D
60. B

COURSE TEST ANSWER SHEET

Occupational Area: PRE & POST
File Code: 77.03.00.00 A2-2
Name: ______________________

ANSWERS

77.03.03.01
61. A ______
62. D ______
63. C ______
64. D ______
65. A ______
02
66. B ______
67. D ______
68. A ______
69. B ______
70. B ______
03
71. C ______
72. B ______
73. B ______
74. D ______
75. A ______
04
76. B ______
77. C ______
78. A ______
79. B ______
80. D ______

05
81. A ______
82. A ______
83. D ______
84. C ______
85. C ______
06
86. D ______
87. B ______
88. D ______
89. B ______
90. B ______
77.03.04.01
91. D ______
92. A ______
93. B ______
94. B ______
95. B ______
02
96. B ______
97. B ______
98. B ______
99. A ______
100. D ______

03
101. D ______
102. D ______
103. D ______
104. D ______
105. C ______
04
106. D ______
107. B ______
108. A ______
109. A ______
110. B ______
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111. B ______
112. B ______
113. A ______
114. B ______
115. B ______
77.03.05.01
116. D ______
117. D ______
118. D ______
119. A ______
120. D ______

COURSE TEST ANSWER SHEET

Occupational Area: PRE & POST
File Code: 77.03.00.00 A2-2
Name: ______________________

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02
121. C ______
122. A ______
123. B ______
124. A ______
125. A ______
03
126. D ______
127. A ______
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128. A ______
129. D ______
130. B ______
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132. D ______
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135. C ______
77.03.06.01
136. D ______
137. D ______
138. D ______
139. C ______
140. D ______

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141. C ______
142. D ______
143. D ______
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145. B ______
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147. A ______
148. C ______
149. A ______
150. D ______
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152. A ______
153. D ______
154. D ______
155. D ______
77.03.07.01
156. A ______
157. B ______
158. C ______
159. D ______
160. A ______

02
161. D ______
162. C ______
163. A ______
164. A ______
165. C ______
03
166. D ______
167. B ______
168. C ______
169. B ______
170. C ______
04
171. C ______
172. A ______
173. B ______
174. C ______
175. D ______
05
176. A ______
177. D ______
178. B ______
179. D ______
180. D ______

COURSE TEST ANSWER SHEET

Occupational Area: PRE & POST
File Code: 77.03.00.00 A2-2
Name: ____________

ANSWERS

06

181. C
182. C
183. C
184. B
185. B
186. ______
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233. ______
234. ______
235. ______
236. ______
237. ______
238. ______
239. ______
240. ______

Student: ______________ File Code: 77.03.00.00. A2-2

Date: ______________ Date Published: 8/1/74

Mountain-Plains Education &
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Glasgow AFB, Montana 59231

COURSE POST TEST: BASIC RADIO THEORY AND COMPONENT ASSEMBLY

77.03.01.01.

1. How much insulation should be removed from the end of a wire to insure a good connection?

   a. 1/2 inch
   b. 3/4 inch
   c. 1/8 inch
   d. 1/4 inch

2. Why shouldn't you move the wire in a freshly soldered joint that is still hot?

   a. you have to reheat the joint anyway
   b. you have to add the flux at this time
   c. you will get a brittle connection
   d. your result will be a cold solder connection

3. The best size iron for soldering in electronic circuits is:

   a. 25-100w.
   b. 10-25w.
   c. 125-150 degrees F.
   d. 100-125w.

4. What type of flux do you use in electronic applications?

   a. acid flux
   b. 60/40
   c. 40/60
   d. rosin flux

5. When a wire is to be soldered to a terminal in a radio, what is the iron applied to?

   a. the terminal
   b. the wire
   c. the solder
   d. the wire and terminal

Student: ______________________ File Code: 77.03.00.00. A2-2

Date: ______________________ Date Published: 8/1/74

Mountain-Plains Education &
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Glasgow AFB, Montana 59231

COURSE PRETEST: BASIC RADIO THEORY AND COMPONENT ASSEMBLY

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   a. the terminal
   b. the wire
   c. the solder
   d. the wire and terminal

77.03.01.02

6. How fast do radio waves travel in free space?

    a. 186,00 MPS
    b. 50,000 MPS
    c. 1.80 (10-6) MPS
    d. 250 MPS

7. What part of the sky reflects radio waves back to the earth?

    a. ionosphere
    b. atmosphere
    c. sundogs
    d. stratosphere

8. Which signal would take the shortest time to get to the same receiver if they were both transmitted at the same time?

    a. ground waves
    b. neither one
    c. both of them will
    d. sky-wave

9. The abbreviation "KC" stands for how many cycles per second in a radio receiver?

    a. 1000
    b. 160,000
    c. 500
    d. 10,000

10. The range of frequencies in radio transmission that are above the audio limit are called:

    a. low range frequencies
    b. long range frequencies
    c. broadcast band
    d. radio frequency current

11. The signal which is being broadcast that carries in it the voice intelligence has:

    a. F.M.
    b. been filtered
    c. been modulated
    d. amplitude

12. The __________ of an A.C. current is determined by the number of cycles that take place in one second.

    a. direction
    b. speed
    c. pulses
    d. frequency

77.03.01.04

13. In a long-wire antenna where does it have its worst reception?

    a. sides
    b. bottom
    c. middle
    d. ends

14. Why do you need a grounding wire on your antenna?

    a. better front end reception
    b. lighting protection
    c. reduces interference
    d. tunes easier

77.03.02.01

15. A radio detector circuit has a R.F. input signal, with an output of:

    a. audio frequency
    b. modulated signal
    c. A.V.C. signal
    d. tuneable R.F. signal

16. In a radio receiver, in order to detect a signal it has to be:

    a. rectified
    b. audio frequency
    c. modulated
    d. tuneable

17. What is the biggest difference between a R.F. amplifier and an A.F. amplifier in a radio receiver audio circuit?

    a. the signal has been tuned to A.F.
    b. a detector is involved
    c. no modulation is involved
    d. no tuning

18. What do you call the function in a radio when it transforms modulated radio frequency signal into audio signal?

    a. to modulate
    b. to amplify
    c. to demodulate
    d. to detect

77.03.02.02

19. Why is it, in a crystal diode, current will flow in only one direction?

    a. high resistance both ways
    b. high back resistance
    c. high front resistance
    d. low resistance both ways

77.03.02.02 (continued)

20. What is the material inside the glass envelope of a signal crystal diode?

a. germanium
b. connecting lead
c. selenium
d. gas

77.03.02.03

21. When you use a radio amplifier in a radio chassis, what can you use for a filter to screen out R.F. spikes?

a. RC network
b. low-pan filter
c. RL network
d. PI network

22. The main step in extracting the audio signal from a modulated broadcast signal is to:

a. tune it
b. amplify it
c. modulate it
d. rectify it

23. Detection in a superheterodyne radio receiver occurs where in a radio?

a. following the audio AMP
b. antenna circuit
c. preceding the if AMP
d. preceding the audio amplifier

24. Two functions involved in the detection of a R.F. signal in an A.M. radio chassis are rectification and:

a. modulation
b. amplification
c. pulsating
d. filtering

77.03.02.04

25. Why does a speaker tend to filter the A.F. which is supplied to it?

a. too slow
b. doesn't have an audio AMP
c. needs a volume control
d. responds only to R.F. signal

77.03.02.04 (continued)

26. What in the voice coil of a speaker or earphone is placed in so it will move back and forth?

a. A.F. signal
b. crystal
c. cabinet
d. permanent magnet

77.03.02.05

27. If you remove the source of voltage from a capacitor out of circuit is there still any voltage across the capacitor?

a. yes, if the electrolyte is low
b. maybe, depends on the circuit
c. no
d. yes

28. A change on a capacitor will last indefinitely until a __________ is placed across its plate.

a. battery
b. circuit
c. another condenser
d. power source

29. What is the term used in a radio receiver when it is referred to as tuned circuit?

a. selectivity
b. proper frequency
c. resonant
d. I.F. rejection

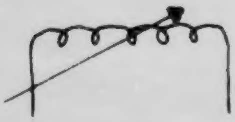
77.03.02.06

30. The electrical characteristic of a coil that influences a kick-back action in a tuned radio circuit is called:

a. reactance
b. resistance
c. inductance
d. reluctance

31. The following symbol represents a:

a. potuntometer
b. varible capacitor
c. varible resistor
d. varible coil



77.03.02.07

32. What are the two elements that you will find in a diode type tube to make it function?

    a. grid and filament
    b. plate and cathode
    c. mercury gas and cathode
    d. ion gas and plate

33. What is the proper name of the device in a vacuum tube diode that raises the temperature inside?

    a. cathode
    b. cylinder oven
    c. plate
    d. filament

34. Does the filament of a vacuum tube have any relation to how much current will conduct in a tube?

    a. no
    b. only if it is connected to the cathode
    c. yes, it regulates how much temperature is put on the cathode
    d. yes, if it is also heating the plate

77.03.02.08

35. What is a common mistake a person will make when soldering a component?

    a. not enough solder
    b. too much heat
    c. crimping wire
    d. too much solder

36. When wiring tube socket pins to the grounded center shield, what kind of wire do you use?

    a. copper insulated
    b. bare
    c. grounding strap
    d. insulated

77.03.03.01

37. If the grid on a triode vacuum tube is connected to a ________ it will act to assist the plate in attracting electrons across the tube.

    a. positive voltage
    b. plate load
    c. negative voltage
    d. ground

77.03.03.01 (continued)

38. A high negative grid of a triode tube will actually ________ the electrons.

   a. amplify
   b. attract
   c. repel
   d. accelerate

39. When the grid of a triode tube becomes highly negative, your _______ across the plate load disappears.

   a. voltage
   b. resistance
   c. reactance
   d. impedance

77.03.03.02

40. What is the purpose of an electrolytic capacitor in a power supply of an electronic receiver?

   a. to provide capacitive reactance
   b. to filter D.C.
   c. to step up the voltage
   d. to put a load on the transformer

41. The original purpose for self-biasing a triode tube in an amplifier circuit was to make the grid more _____ with respect to the cathode.

   a. negative
   b. positive
   c. resistive
   d. powerful

42. In a triode tube amplifier, the plate is positive and the cathode is negative. Your control grid is also negative. Where do you apply your input signal to in a radio circuit?

   a. plate load resistor
   b. grid
   c. cathode
   d. plate

77.03.03.03

43. When you apply a signal to the unbiased control grid of a triode in an amplifier circuit, only the _____ of this signal will apear in the plate circuit.

   a. only .636
   b. negative half-cycle
   c. positive half-cycle
   d. only 1.414

77.03.03.03 (continued)

44. Even though the signal applied to a vacuum tube amplifier swings plus and minus, the grid remains _______ because of the supply voltage.

a. positive
b. negative
c. plus and minus
d. open circuit

45. When you lose grid bias voltage on a triode amplifier tube, or when it swings positive, a very ____ charge will occur across the plate load resistor.

a. uneven
b. positive
c. small
d. large

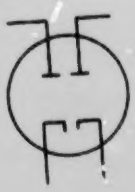
77.03.03.04

46. In a triode amplifier, the negative half of the signal is amplified satisfactorily and the positive half of the signal:

a. distorts
b. cancels out
c. doubles
d. amplifies

47. What tube does this symbol stand for?

a. diode
b. triode
c. pentode
d. duo-diode



77.03.03.05

48. The objective for regeneration in a detector-amplifier circuit is to increase the amplification of the circuit but not to cause:

a. oscillation
b. motor bosting
c. resonant
d. boot-strapping

49. What is another term for feedback control used in a R.F. amp-circuit in an electronic device?

a. BFO control
b. RL control
c. regeneration control
d. oscillation control

77.03.03.05

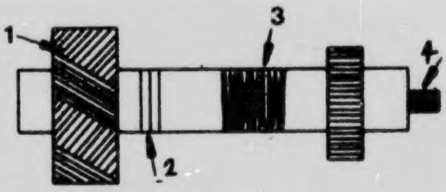
50. The feedback control installed in a regenerative feedback circuit does what main function in this circuit?

   a. varies the frequency
   b. changes the inductance of the coil
   c. controls amount of feedback
   d. changes frequency of the RLC network

77.03.03.06

51. In the diagram, which winding is the primary winding?

   a. 2
   b. 4
   c. 3
   d. 1

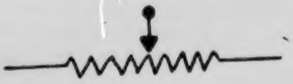


52. Where, in the diagram for question 51, will you find the tickler winding?

   a. 4
   b. 2
   c. 3
   d. 1

53. The following electronic symbol stands for a:

   a. varible transformer
   b. varible resistor
   c. a fixed 1/4w resistor
   d. varible capacitor



77.03.04.01

54. How hot should the serviceman allow the joint to get while soldering?

   a. as hot as he can get it
   b. just hot enough to allow the solder to flow smoothly
   c. hot enough to fill the entire hole of the terminal
   d. hot enough to make the solder drop off the joint

55. When desoldering a component or making a temporary connection, which type of joint should be used?

   a. crimp joint
   b. lap joint
   c. u-joint
   d. hooked joint

77.03.04.01 (continued)

56. Why should the lead of a wire be held with a plier while it is being stripped of insulation?

   a. to keep from breaking it
   b. to keep from fraying
   c. to keep it clean
   d. to make soldering easier

77.03.04.02

57. A step-up power transformer in a radio or TV chassis has:

   a. a frequency input and a high frequency output
   b. a voltage input and high voltage output
   c. a power input and high power output
   d. a current input and a high current output

58. In air-core coils, the coil is wound around a:

   a. powered iron core
   b. coil form
   c. winding
   d. core

59. If a 3:1 ratio step-down transformer has 3A of current in the primary, what is the current in the secondary?

   a. 9A
   b. 6A
   c. 1A
   d. 3A

60. The extent of coupling between two inductors is expressed by the terms:

   a. varying current
   b. counter emf
   c. self-inductance
   d. coefficient of coupling

77.03.04.03

61. What is the efficiency of a 1:2 transformer which has an input of 120W and an output of 180W?

   a. 50%
   b. 94%
   c. 100%
   d. 90%

77.03.04.03

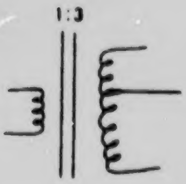
62. Radio chassis' power transformer cores are laminated in order to:

a. reduce resistance
b. reduce mutual inductance
c. increase displacement currents
d. reduce eddy currents

63. A step-down transformer in a radio chassis receives energy at one voltage and delivers it at:

a. a high frequency
b. a lower frequency
c. a high voltage
d. a lower voltage

64. The following schematic symbol is for a:



a. step-down, air-core, tapped transformer
b. step-down, iron-core, tapped-secondary transformer
c. step-up, iron-core, tapped-secondary transformer
d. step-up, air-core, tapped transformer

77.03.04.04

65. The ripple frequency of a full-wave rectifier power supply is:

a. independent of the A.C. supply frequency
b. equal to the A.C. supply frequency
c. one-half the A.C. supply frequency
d. twice the A.C. supply frequency

66. When a rectifier is reverse biased in a radio or TV power supply its resistance is:

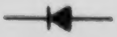
a. minimum
b. high
c. infinite
d. low

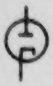
67. A diode placed in a circuit so that it permits current to flow through it is said to be:

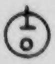
a. forward biased
b. passing biased
c. blocking biased
d. reverse biased

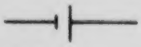
77.03.04.04 (continued)

68. The schematic symbol for a semi-conductor rectifying diode in a radio power supply is:

A 

B 

C 

D 

69. Because a capacitor absorbs energy during the pulse, and delivers it to the load of a radio between pulses, the output voltage:

a. falls to zero
b. never falls to zero
c. always remains the same
d. peaks

77.03.04.05

70. What type of power supply filter is used for applications requiring a uniform flow a current?

a. RC filter
b. L-section
c. PI-section
d. capacitance input

71. The major advantage of using an inductance filter in a radio power supply is:

a. its nearly constant current output
b. its high output voltage
c. its lower current output
d. its lower voltage output

72. What type of power supply is used for applications that require low volumes of output current?

a. band eliminator
b. capacitance input
c. simple inductor
d. L-section

77.03.04.05

73. When polarity markings are indicated on the body of a semi-conductor rectifier, how is the rectifier placed in an active circuit?

a. load in series
b. source in series
c. source in parallel
d. load in parallel

77.03.05.01

74. What is the main disadvantage of a tetrode vacuum tube?

a. reduces oscillation
b. reduces distortion
c. has high interelectrode capacitance
d. has secondary emission

75. In respect to the plate, what is the potential on the screen grid in a tetrode vacuum tube?

a. negative
b. same as cathode
c. same as control grid
d. positive

76. How many elements does a tetrode vacuum tube have not counting the filaments?

a. 5
b. 3
c. 2
d. 4

77. What is the purpose of the resistor in series with the cathode on a triode tube?

a. biasing
b. amplifying
c. a power source
d. to drop current

78. What is the name of the element found in a tetrode tube, but not in a triode vacuum tube?

a. control grid
b. cathode
c. filament
d. screen grid

77.03.05.02

79. Which of the following tubes has the highest amplification factor?

a. tetrode
b. triode
c. pentode
d. diode

80. When a small signal at the grid of a vacuum tube causes a large amount of current to flow through the tube, this is called:

a. amplification
b. demodulation
c. acceleration
d. secondary emission

81. What does the suppressor grid of a pentode vacuum tube do to the electrons that are bounced from the plate?

a. pass
b. repel
c ground
d. attract

82. In a tetrode or pentode tube, what type of voltage must be applied to the screen grid in order to make it operate?

a. high + D.C.
b. high A.C.
c. low A.C.
d. low + D.C.

77.03.05.03

83. How effectively an audio amplifier reproduces sound depends mostly on:

a. its modulation ability
b. its linearity
c. its power factor
d. the frequency response

84. What is the main purpose of coupling capacitors when used in radio circuits?

a. to block DC
b. to block AC
c. to pass DC
d. to ground the control grid

77.03.05.04

85. What is the purpose of the cathode resistor in an audio amplifier tube of a radio?

    a. bias
    b. amplification factor
    c. grounding the suppressor grid
    d. load resistor

77.03.05.05

86. Which end of a diode is marked?

    a. the high resistance end
    b. the cathode end
    c. the anode end
    d. the low resistance end

87. If a diode is used as a detector, most likely it is a:

    a. silicon type
    b. PNP type
    c. NPN type
    d. germanium type

77.03.05.06

88. Detection might be best described as:

    a. amplifying audio signals
    b. inserting audio signals onto an R.F. carrier
    c. separating the audio signals from the radio-frequency signals
    d. removing the audio from a signal so only the R.F. is amplified

77.03.06.01

89. In a radio receiver, the main function of the RF section is to tune and:

    a. select the signal
    b. modulate the signal
    c. detect the signal
    d. amplify the signal

90. In a resonant circuit of an AM radio, which component normally changes the resonant frequency of the RF AMP section?

    a. a tube
    b. a coupling capacitor
    c. a variable coil
    d. a variable capacitor

77.03.06.01 (continued)

91. In a radio chassis, the signal is fed to which of the following grids of a RF amplifier's pentode tube?

a. screen frid
b. suppressor grid
c. cathode
d. control grid

77.03.06.02

92. In a tuned resonant circuit, what amount of current flows back and forth between the coil and athe capacitor?

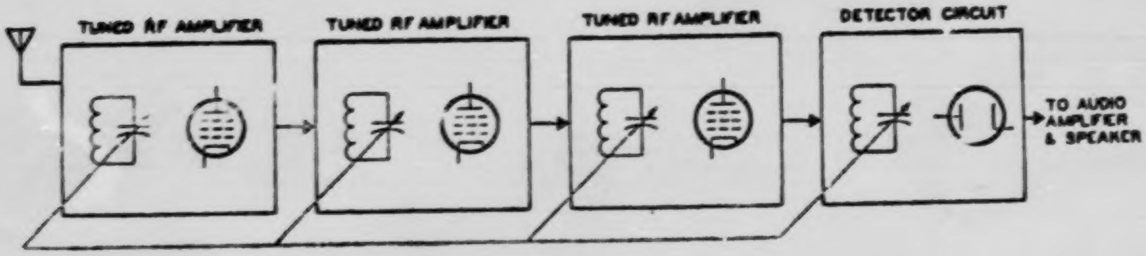
a. small
b. weak
c. low
d. large

93. The RF section of a broadcast receiver has what functions?

a. to select and amplify the proper signal
b. to select the proper signal only
c. to amplify all frequencies within the audio range
d. to amplify the proper signal only

94. What do the dotted lines symbolize in the illustration below?

a. an alternate circuit
b. a ganged capacitor
c. a trimmer capacitor
d. an old radio


TUNED RF AMPLIFIER
TUNED RF AMPLIFIER
TUNED RF AMPLIFIER
DETECTOR CIRCUIT
TO AUDIO AMPLIFIER & SPEAKER

77.03.06.03

95. An oscillator in radio circuit is used to generate:

a. AC
b. frequencise
c. DC
d. audio

77.03.06.03 (continued)

96. What occurs when a maximum amount of current flows through a tube in an electronic circuit?

    a. secondary emission
    b. ionization
    c. saturation
    d. emission

97. The main purpose of an oscillator circuit in a radio oscillator is:

    a. outside voltage
    b. feedback
    c. dampening
    d. frequency stabilization

98. An oscillator circuit will keep oscillating because it:

    a. dampens the tuned circuit every other cycle
    b. superheterodynes the tuned circuit every cycle
    c. provides feedback to the tuned circuit every other cycle
    d. pulses new energy into the tuned circuit every cycle

77.03.06.04

99. The frequency of an oscillator in radio depends largely upon the:

    a. operating voltage
    b. resitance in the circuit
    c. grid bias
    d. value of the coil and condenser

100. The quickest method for determining whether or not an oscillator is functioning is to measure its:

    a. grid-bias potential
    b. plate potential
    c. cathode voltage
    d. frequency

101. The trimmer capacitor in an oscillator feedback circuit:

    a. matches impedance with the coil
    b. changes the selectivity
    c. changes the sensitivity
    d. changes the frequency

77.03.06.04 (continued)

102.. How are oscillations made continous in a vacuum-tube circuit?

a. by using a triode with a high amplification factor
b. by degeneration in the grid circuit of the tube
c. by high plate voltage on the oscillator tube
d. by feedback from plate to grid

103. The local oscillator frequency of a broadcast band receiver is:

a. lower in frequency than the incoming frequency
b. the same frequency as the incoming frequency
c. the same as the if frequency
d. equal to the sum of the incoming frequency plus the if frequency

77.03.07.01

104. What type of tube may be used in the radio mixer circuit?

a. pentagrid
b. tetrode
c. triode
d. pentode

105. What is the I.F. AMP input frequency in a superheterodyne receiver?

a. 45.5 KHZ
b. 455 KHZ
c. 4.55 HZ
d. 455 MHZ

106. Why can a high Q coil be used in the I.F. amplifier of a superheterodyne radio?

a. better signal strength
b. high frequency input
c. because of the single frequency of the I.F.
d. utilizes a local oscillator

107. The primary function of a converter tube of a superheterodyne receiver is to combine two:

a. oscillations
b. currents
c. voltages
d. signals

108. One signal to be mixed comes from the radio station, the other comes from:

a. the local oscillator
b. the timmer capacitor
c. the I.F. amplifier
d. the R.F. amplifier

77.03.07.02

109. What is the function of the AVC filter in a superheterodyne radio?

    a. frequency tuning
    b. coupling
    c. changes AC to DC
    d. changes PDC to DC

110. What is the purpose of the AVC circuit in a radio chassis?

    a. strengthen the signal
    b. control the R.F. signal
    c. control amplification
    d. control the grid bias

111. A smaller input signal to the R.F. AMP will consequently result in:

    a. a lower AVC voltage
    b. no AVC voltage
    c. a higher AVC voltage
    d. no change

112. Does the volume control of a superheterodyne radio have any effect on the AVC voltage?

    a. no
    b. yes
    c. possibly
    d. occasionally

77.03.07.03

113. The oscillator circuit in a superheterodyn receiver must be aligned to:

    a. 455 KC
    b. the I.F. frequency
    c. the frequency of the received signal
    d. the frequency of the received signal plus 455 KC

77.03.07.04

114. When aligning a radio receiver, the V.O.M. is usually connected to the:

    a. audio output
    b. I.F. AMP
    c. AVC filter
    d. speaker

77.03.07.04 (continued)

115. The top and bottom slug of each I.F transformer should be adjusted for:

    a. local station frequency
    b. maximum volume
    c. AVC voltage
    d. 455 KG

116. When adjusting the antenna coil, where should the volume control be set?

    a. high
    b. off
    c. low
    d. mid-range

117. When aligning a superheterodyne receiver, one should start with the:

    a. padder capacitor
    b. trimmer capacitor on the tuning capacitor
    c. I.F. transformer nearest the R.F. section
    d. R.F. oscillator-tuning coil slug

77.03.07.05

118. What components in a radio change when the band selector is repositioned from A.M. to short wave?

    a. I.F. circuit
    b. detector circuit
    c. local oscillator
    d. antenna and oscillator circuits

119. What is a nickname for morse code signals?

    a. teletype
    b. CW
    c. F.M.
    d. WWV

120. The signal of the BFO is coupled to the:

    a. grid of the R.F. AMP
    b. grid of the mixer-oscillator
    c. grid of the detector
    d. grid of the I.F. AMP

121. What is the biggest difference between a standard A.M. radio and a short wave radio?

    a. I.F. AMP
    b. detector
    c. antenna and oscillator
    d. BFO

77.03.07.06

122. What do the initials "BFO" refer to in a short wave radio?

a. code for CW
b. beat-frequency oscillator
c. code for WWV
d. before first osxillator

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Learning Experience Guide

UNIT: INTRODUCTION TO RADIO

RATIONALE:

This Unit will introduce you to basic concepts of sending and receiving radio signals. Basic knowledge about radio signals sets the stage for understanding the reason for each section in a radio. Each radio section does something with some part of the radio signal. Understanding the relations between the components of a radio signal and the radio section is basic to developing troubleshooting techniques.

PREREQUISITES:

Course: AC Circuits

OBJECTIVES:

Given a basic radio text/workbook, the necessary tools and equipment, identify basic characteristics of radio signals and install a broadcast receiving antenna.

RESOURCES:

Printed Materials

Basic Radio, Part 1. Heath Company, Benton Harbor, Michigan, 1960.
Electronics Assembly and Fabrication Methods. Duarte and Duarte, McGraw-Hill Book Company, 1973.

Equipment

Drill, power
Drill bits
Basic Radio Kit, Heathkit Model EK-2, Heathkit Company, Benton, Harbor, Michigan.
Soldering iron.
Service Master Kit 99 SM or equivalent - Xcelite 99 SM Kit, Jenson Tools and Alloys, 4117 North 44th Street, Phoenix, Arizona.
Soldering tools.
Ladder, step (6 ft.).

Principal Author(s): B. Vetter

GENERAL INSTRUCTIONS:

You have been prescribed to the first unit of this course. The activities that you perform will be assigned one at a time. A LAP will give you directions for each activity. Read the LAP and follow the procedure and directions given.

After completing each LAP, you are to take the LAP test, score it, and find out the reason for any missed items before beginning the next assigned LAP.

When you finish the performance activities for the unit, you will be given a unit test as stated in the "Evaluation Procedures" for post testing. After successful completion of the unit test, the next assigned unit for the course is begun.

PERFORMANCE ACTIVITIES:

.01 Soldering Techniques
.02 Radio Transmission
.03 Signal Characteristics
.04 Constructing Long-Wire Receiving Antenna

EVALUATION PROCEDURES:

When pretesting:

1. The student takes the unit multiple-choice pretest.
2. Successful completion is 4 out of 5 items for each LAP part of the pretest.
3. The student then takes a unit performance test if the unit pretest was successfully completed.
4. Satisfactory completion of the performance test is meeting the criteria listed on the performance test.

When post testing:

1. The student take s a multiple-choice unit post test and a unit performance test.
2. Successful unit completion is meeting the listed criteria for the performance test.

FOLLOW-THROUGH:

After completing this guide, begin with the first LAP in this Unit. If you have questions, please contact your instructor.

Student: ______________________ File Code: 77.03.01.00. A2-2

Date: ______________________ Date Published: 4/1/75

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UNIT PRETEST: INTRODUCTION TO RADIO

77.03.01.01.

1. When soldering, what keeps the solder where you want it?

   a. heat sink
   b. soldering iron
   c. pliers
   d. gravity

2. What side of your soldering iron tip should be against the joint to be soldered?

   a. round
   b. butt-end
   c. flat
   d. square

3. Why should you hold the lead of a wire being stripped with a plier?

   a. to solder it more easily
   b. to keep it clean
   c. to keep it from fraying
   d. to keep from breaking it

4. In a radio or TV chassis, whenever there is a possibility of bare leads shorting to other parts, or to the chassis, the leads should be covered with:

   a. sleeving
   b. tape
   c. cloth
   d. plastic shields

5. How large is the soldering gun you can use to solder in electronic applications?

   a. 100-200 W
   b. 100-125 W
   c. 25-100 W
   d. 15-20 W

77.03.01.02.

6. What kind of transmitting antenna radiates in all directions?

   a. directional
   b. latoral directional
   c. non-directional
   d. uni-directional

7. In a broadcast studio, what is the job of the microphone?

   a. to convert mechanical vibration to electronic vibration
   b. to transmit radio waves
   c. to be plugged into an audio AMP
   d. to create an audio signal

8. Broadcast stations in the U.S. vary in power from 50,000W down to:

   a. 500W.
   b. 250W.
   c. 195W.
   d. 1000W.

9. What section or part feeds your radio station antenna?

   a. driver
   b. microphone
   c. transmitter
   d. studio

10. Does geography have an effect on radio waves in free space?

   a. no
   b. no, just the atmosphere
   c. no, just the sun
   d. yes

77.03.01.03.

11. In A.C. theory, one plus swing and one minus swing constitutes a:

   a. frequency
   b. pulse
   c. cycle
   d. pulsating D.C.

77.03.01.03. continued:

12. What is shown by the distance on a zero-current line of a graph representing A.C.?

    a. frequency
    b. XC
    c. XL
    d. time elapsed

13. Which word is used to describe current when the current contains some kind of intelligence.

    a. audio
    b. radio frequency
    c. A.C.
    d. signal

14. How much time does it take for 60HZ house current to complete one cycle?

    a. one hour
    b. 1/60th second
    c. 120 seconds
    d. 60 seconds

15. Frequency between 20 to 20KHZ in a radio is considered:

    a. too high
    b. signal. .
    c. modulation.
    d. audio.

77.03.01.04.

16. When you mount your antenna, which way will it be toward the station?

    a. 45 degrees to the left
    b. pointed at
    c. broadside
    d. 45 degrees to the right

77.03.01.04. continued:

17. What objects are required for hanging a radio receiver antenna?

a. short
b. insulated
c. tall
d. wet

18. How much wire do you need for antenna lead-in and grounding?

a. 75
b. 105
c. 60
d. 30

19. Why should you tie a knot with your lead-in wire through the insulator?

a. to relieve strain
b. to get a better connection
c. to improve reception
d. for better grounding

20. You have two radio stations in your area. From your antenna there is a 90 degree difference between station A and station B. Station B is weaker than A. Which direction would you point your antenna?

a. 45 degrees away from B
b. toward B
c. 45 degrees toward station B
d. toward A

UNIT PRETEST ANSWER KEY: INTRODUCTION TO RADIO

LAP		
01	1.	D
	2.	C
	3.	A
	4.	A
	5.	C
02	6.	C
	7.	A
	8.	B
	9.	C
	10.	D
03	11.	C
	12.	D
	13.	D
	14.	B
	15.	D
04	16.	C
	17.	C
	18.	B
	19.	A
	20.	D

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File Code: 77.03.01.01.A2-0

Date Published: 11/12/75

Learning Activity Package

Student: __________

Date: __________

PERFORMANCE ACTIVITY: Soldering Techniques

OBJECTIVE:

Given the tools, supplies and equipment, solder electrical connections using proper procedures.

EVALUATION PROCEDURE:

Soldering is evaluated on the Unit Performance test.

Successfully complete at least 80% of the items on a multiple-choice test about this LAP.

RESOURCES:

Electronics Assembly and Fabrication Methods, Duarte.

Hand Tools.
Soldering Iron.
Solder (flux resin core).
Soldering Tools.

PROCEDURE:

1. Do the following assignments using Electronics Assembly and Fabrication Methods.
    a. Read about "Tinning" page 90.
    b. Read "How to Tin the Tip of a Soldering Iron" page 101 and "How to Tin Wire with a Soldering Iron" page 102.
    c. Tin the tip of the soldering iron following the procedures for Job 6.1 on page 101.
    d. Tin wire using the procedures for Job 6.2 on page 102.
2. Take the soldering iron and tinned wire to the instructor for evaluation.

Principal Author(s): B. Vetter

PROCEDURE CONT.:

3. If the tinning is satisfactory, begin step 4. If the tinning is unsatisfactory, proceed as directed by the instructor.

4. Do the following assignments using Electronics Assembly and Fabrication.

    a. Answer questions for Job 6.1 on page 102 and for Job 6.2 on page 103.

    b. Check answers with answer key.

5. If no discrepancies exist, begin the next step. Determine the reason for any existing discrepancies.

6. Do the following assignments using Electronics Assembly and Fabrication:

    a. Read about "Improper Soldering Results", page 93.

    b. Read "How to Inspect the Quality of a Soldered Joint", page 107.

    c. Inspect the quality of soldered joints using the procedures in Job 6.8, page 107.

    d. Answer the questions for Job 6.8, page 108.

    e. Check your answers with answer key.

7. If no discrepancies exist, take the LAP test. Determine the reason for any existing discrepancies.

8. Correct and return LAP test.

9. If the LAP test is satisfactory, begin the next assigned LAP. If the test is unsatisfactory, proceed as the instructor directs.

LAP TEST ANSWER KEY: SOLDERING TECHNIQUES

1. B
2. D
3. A
4. B
5. B
6. A
7. D
8. A
9. D
10. B

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Learning Activity Package

Student: ______

Date: ______

PERFORMANCE ACTIVITY: Radio Transmission

OBJECTIVE:

Describe the transmission of radio waves, i.e., signal transmission, signal radiation and signal detection.

EVALUATION PROCEDURE:

Successfully complete at least 80% of the items on a multiple-choice test about this LAP.

RESOURCES:

Basic Radio Part 1, Heath Company.

PROCEDURE:

1. Read Basic Radio, (Part 1), Lesson 1, pages 1-6.
2. Answer the review questions on a separate sheet of paper.
3. Check answers with the answer key on page 84.
4. Take the LAP test.

Principal Author(s): P. Schuster

LAP TEST ANSWER KEY: RADIO TRANSMISSION

1. D
2. A
3. B
4. B
5. A
6. A
7. D
8. A
9. D
10. C

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Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Signal Characteristics

OBJECTIVE:

Define the various functions and effects of broadcast radio signals and signal components.

EVALUATION PROCEDURE:

Successfully complete at least 80% of the items on a multiple-choice test about this LAP.

RESOURCES:

Basic Radio, Part 1, Heath Company.

PROCEDURE:

1. Read pages 7-11 in Basic Radio, (Part 1).
2. Take the LAP test.

Principal Author(s): P. Schuster

LAP TEST ANSWER KEY: SIGNAL CHARACTERISTICS

1. D
2. C
3. B
4. B
5. A
6. B
7. A
8. B
9. B
10. C

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Learning Activity Package

Student: ____________

Date: ____________

PERFORMANCE ACTIVITY: Constructing Long-Wire Receiving Antenna

OBJECTIVE:

Construct a radio receiving antenna according to the manufacturer's specifications.

EVALUATION PROCEDURE:

Successfully complete at least 80% of the items on a multiple-choice test about this LAP.

Antenna installation meets criteria on the attached checklist.

RESOURCES:

Basic Radio, Part 1, Heath Company.
Heath Kit EK -2A.
Hand tools.
Ladder, step (6 ft.).

PROCEDURE:

1. Read pages 11-14 in Basic Radio (Part 1).
2. Construct a broadcast receiving antenna using the procedures on pages 11-13.
   CAUTION: When climbing be sure to follow safe practices.
3. Answer the questions on page 14, on a separate sheet of paper.
4. Check answers with answer key on page 84.
5. Take the LAP test.

Principal Author(s): P. Schuster

CHECKLIST: CONSTRUCTING LONG-WIRE RECEIVING ANTENNA

______ 1. Proper selection of parts, equipment and supplies.

______ 2. Proper selection of antenna location.

______ 3. Proper installation procedures followed.

______ 4. Neatness.

______ 5. Safe practices and procedures followed.

LAP TEST ANSWER KEY: CONSTRUCTING LONG-WIRE RECEIVING ANTENNA

1. D
2. C
3. D
4. C
5. A
6. D
7. B
8. C
9. C
10. C

Student: ______________________ File Code: 77.03.01.00. B2-2

Date: ______________________ Date Published: 8/5/74

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UNIT POST TEST: INTRODUCTION TO RADIO

77.03.01.01.

1. Why shouldn't you move the wire in a freshly soldered joint that is still hot?

   a. you will get a brittle connection
   b. you have to add the flux at this time
   c. you have to reheat the joint anyway
   d. your result will be a cold solder connection

2. Why must the terminal to be soldered in an electronic application be clean?

   a. to dissipate heat
   b. to get a good solder connection
   c. so you can crimp the wires easily
   d. because the instruction manual doesn't say so

3. The best size iron for soldering in electronic circuits is:

   a. 25-100W
   b. 100-125W
   c. 10-25W
   d. 125-150 degrees F.

4. What type of flux do you use in electronic applications?

   a. acid flux
   b. 60/40
   c. rosin flux
   d. 40/60

5. How much insulation should be removed from the end of a wire to insure a good connection?

   a. 1/4 inch
   b. 1/8 inch
   c. 1/2 inch
   d. 3/4 inch

77.03.01.02.

6. What part of the sky reflects radio waves back to the earth?

   a. stratosphere
   b. atmosphere
   c. sundogs
   d. ionosphere

7. The broadcast band for A.M. radio in the U.S. is between:

   a. 550KC to 1600KC
   b. 250HZ to 50,000HZ
   c. 60KZ to 15750KZ
   d. 550MHZ to 1600 MHZ

8. What must the radio receiver do to the signal so we might hear it?

   a. modulate it
   b. amplify it
   c. beat it with a harmonic
   d. demodulate it

9. What part of our government determines what frequency a radio station may operate on?

   a. local government
   b. F.A.A.
   c. I.C.C.
   d. F.C.C.

10. What kind of circuits would pick up many stations at once?

   a. tuned
   b. antenna
   c. R.F. AMP
   d. I.F. AMP

77.03.01.03.

11. An audio signal in a radio transmission is A.C. current up to______CPS that carries sound in electrical form.

   a. 2,000
   b. 60
   c. 20,000
   d. 110

77.03.01.03. continued:

12. The signal which is being broadcast that carries in it the voice intelligence has:

   a. been modulated.
   b. amplitude.
   c. F.M.
   d. been filtered.

13. An incoming radio signal on an antenna is a special form of:

   a. current.
   b. voltage.
   c. resistance.
   d. power.

14. On a graph with A.C., everything above a base line is:

   a. negative.
   b. in phase.
   c. positive.
   d. out of phase.

15. Which characteristic of an A.C. current is determined by the number of cycles that take place in one second?

   a. speed
   b. direction
   c. pulses
   d. frequency

77.03.01.04.

16. In a long-wire antenna, where does it have its worst reception?

   a. bottom
   b. sides
   c. middle
   d. ends

17. The antenna for receiving should be kept away from objects that will cause:

   a. interference.
   b. frequency change.
   c. modulation.
   d. power loss.

77.03.01.04. continued:

18. In a long-wire antenna, where does it have its best reception?

    a. bottom
    b. ends
    c. sides
    d. top

19. Why should you use stranded wire for your antenna instead of solid wire?

    a. takes stress better
    b. grounds better
    c. tunes better
    d. receives better

20. In addition to having a lead-in wire, you must also:

    a. ground it.
    b. tune it.
    c. solder it.
    d. stretch it.

UNIT POST ANSWER KEY: INTRODUCTION TO RADIO

LAP		
01	1.	D
	2.	B
	3.	A
	4.	C
	5.	A
02	6.	D
	7.	A
	8.	B
	9.	D
	10.	A
03	11.	C
	12.	A
	13.	A
	14.	C
	15.	D
04	16.	D
	17.	A
	18.	C
	19.	A
	20.	A

Student: ____________ File Code: 77.03.01.00.A1-5

Date: ____________ Date Published: 11-14-74

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Family Pay Number: ____________ Sex: M F (Circle 1)

UNIT PERFORMANCE TEST: INTRODUCTION TO RADIO

OBJECTIVE:

Construct and install a broadcast radio receiving antenna.

TASK:

The student will be given materials and tools and asked to construct and install a broadcast radio receiving antenna.

ASSIGNMENT:

CONDITIONS:

The student will be tested in an environment similar to that of a radio-TV repair shop. He will be supplied with the same tools and reference manuals normally available to radio-TV servicepersons. He may receive no assistance from other students or the instructor.

RESOURCES:

Basic Radio, Part 1, Heath Company, 1961.
Heathkit, Model EK-2A, Heath Company, 1961.
Equipment: Soldering iron, power drill and bit, needle nose pliers and a step ladder.

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Student: ______________________ **File Code:** 77.03.01.00.A1-5

Date: ______________________ **Date Published:** 11-14-74

Family Pay Number: ________________ Sex: M F (Circle 1)

PERFORMANCE CHECKLIST:

OVERALL PERFORMANCE: Satisfactory_____ Unsatisfactory_____

	CRITERION	
	Met	Not Met
Objective 1:		
1. Correct positioning of antenna		
Criterion: Basic Radio, Part 1, Heathkit, page 11.		
2. Ground wire properly installed.		
Criterion: Heathkit Basic Radio, Part 1, page 13.		
3. Insulators properly connected.		
Criterion: Heathkit Basic Radio, Part 1, page 13.		
4. Lead in wire attached and properly soldered.		
Criterion: Heathkit Basic Radio, Part 1, page 13.		
5. Correct attachment of support wire.		
Criterion: Heathkit Basic Radio, Part 1, page 13.		
6. Correct length of antenna.		
Criterion: Heathkit Basic Radio, Part 1, page 11.		
7. Correct length of ground wire,		
Criterion: Heathkit Basic Radio, Part 1, page 11.		

	CRITERION	
	Met	Not Met
8. Test completed in allotted time.		
Criterion: Doesn't exceed 3 hours.		
Student must meet criterion on all line items to obtain an overall score of satisfactory.		

Student: ______________________ File Code: 77.03.01.01. A2-2

Date: ______________________ Date Published: 8/6/74

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LAP TEST: SOLDERING TECHNIQUES

1. What side of your soldering iron tip should be against the joint to be soldered?

   a. round
   b. flat
   c. square
   d. butt-end

2. What type of flux do you use in electronic applications?

   a. acid flux
   b. 60/40
   c. 40/60
   d. rosin flux

3. What kind of joint do you use if you have to desolder a component or to make a temporary connection?

   a. lap joint
   b. hooked joint
   c. u joint
   d. crimp joint

4. A soldering iron works well only when?

   a. heated to 500 degrees F.
   b. the tip is cleaned and tinned
   c. heated to 200 degrees F.
   d. rosin solder is used

5. The best size iron for soldering in electronic circuits is:

   a. 100-125W.
   b. 25-100W.
   c. 125-150 degrees F.
   d. 10-25W.

6. How much insulation should be removed from the end of a wire to insure a good connection?

   a. 1/4 inch
   b. 1/8 inch
   c. 3/4 inch
   d. 1/2 inch

7. When soldering, what keeps the solder where you want it?

   a. pliers
   b. soldering iron
   c. heat sink
   d. gravity

8. Why shouldn't you move the wire in a freshly soldered joint that is still hot?

   a. your result will be a cold solder connection
   b. you will get a brittle connection
   c. you have to reheat the joint anyway
   d. you have to add the flux at this time

9. When a wire is to be soldered to a terminal in a radio, what is the iron applied to?

   a. the terminal
   b. the solder
   c. the wire
   d. the wire and terminal

10. Why must the terminal to be soldered in an electronic application be clean?

    a. so you can crimp the wires easily
    b. to get a good solder connection
    c. to dissipate heat
    d. because the instruction manual doesn't say so

Student: ____________________ File Code: 77.03.01.02. A2-2

Date: ____________________ Date Published: 8/6/74

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LAP TEST: RADIO TRANSMISSION

1. The effect that causes long distance stations to be heard at night that cannot be heard in the daylight hours is commonly referred to as:

   a. delay.
   b. amplification.
   c. modulation.
   d. skip.

2. How often is a radio station required to broadcast its call letter?

   a. every half hour
   b. once a day
   c. every hour on the hour
   d. twice a day

3. The broadcast band for A.M. radio in the U.S. is between:

   a. 60KZ to 15,750KZ
   b. 550KC to 1600KC
   c. 250HZ to 50,000HZ
   d. 550MHZ to 1600MHZ

4. What kind of transmission antenna radiates in all directions?

   a. omni-directional
   b. non-directional
   c. directional
   d. uni-directional

5. Which signal would take the shortest time to get to the same receiver if they were both transmitted at the same time?

   a. ground wave
   b. both of them will
   c. sky-wave
   d. neither one

6. What must the radio receiver do to the signal so we might hear it?

   a. amplify it
   b. demodulate it
   c. modulate it'
   d. detune it

7. What section or part feeds a radio station antenna?

   a. studio
   b. microphone
   c. driver
   d. transmitter

8. Does geography have an effect on radio waves in free space?

   a. yes
   b. no, just the sun
   c. no, just the atmosphere
   d. no

9. Broadcast stations in the U.S. vary in power from 50,000W down to:

   a. 1000W
   b. 195W
   c. 500W
   d. 250W

10. What part of the sky reflects radio waves back to the earth?

   a. atmosphere
   b. stratosphere
   c. ionosphere
   d. sundogs

Student: ______________________ File Code: 77.03.01.03. A2-2

Date: ______________________ Date Published: 8/6/74

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LAP TEST: SIGNAL CHARACTERISTICS

1. How much time does it take for 60HZ house current to complete one cycle?

   a. 60 seconds
   b. one hour
   c. 120 seconds
   d. 1/60th second

2. Does pulsating direct current reverse direction during one cycle?

   a. yes, if it is rectified
   b. only it it was A.C.
   c. no
   d. yes

3. The signal which is being broadcast that carries in it the voice intelligence has been:

   a. F.M.
   b. modulated.
   c. filtered.
   d. amplitude

4. In A.C. theory, one plus swing and one minus swing constitutes a:

   a. frequency.
   b. cycle.
   c. pulse.
   d. pulsating D.C.

5. What is shown by the distance on a zero-current line of a graph representing A.C.?

   a. time elapsed
   b. XC
   c. frequency
   d. XL

6. An audio signal in a radio transmission is A.C. current up to_______ CPS that carries sound in electrical form.

   a. 110
   b. 20,000
   c. 2,000
   d. 60

7. An incoming radio signal on an antenna is a special form of:

   a. current.
   v. power.
   c. voltage.
   d. resistance.

8. The range of frequencies in radio transmission that are above the audio limit are called:

   a. long range frequencies.
   b. radio frequency current.
   c. low range frequencies
   d. broadcast band.

9. What is the process of passing current through a device that will conduct current in only one direction?

   a. pulsating
   b. rectifier
   c. amplify
   d. modulate

10. Which characteristic of an A.C. current is determined by the number of cycles that take place in one second?

   a. speed
   b. pulses
   c. frequency
   d. direction

Student: ______________________ File Code: 77.03.01.04. A2-2

Date: ______________________ Date Published: 4/30/75

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LAP TEST: CONSTRUCTING LONG-WIRE RECEIVING ANTENNA

1. In a long-wire antenna, where does it have its worst reception?

   a. sides
   b. middle
   c. bottom
   d. ends

2. The lead-in wire hooked up to your radio must come from where?

   a. the side
   b. the middle
   c. one end
   d. the insulator

3. How much wire do you need for antenna, lead-in and grounding?

   a. 30'
   b. 75'
   c. 60'
   d. 105'

4. Why should you, on a receiver antenna, solder your lead-in wire to your antenna?

   a. to ground better
   b. to modulate better
   c. to get a low resistance connection
   d. to prevent damage to your house

5. You have two radio stations in your area. From your antenna there is a 90 degree difference between station A and station B. Station B is weaker than A. Which direction would you point your antenna?

   a. toward A
   b. toward B
   c. 45 degrees toward station B
   d. 45 degrees away from B

6. In a long-wire antenna, where does it have its best reception?

   a. top
   b. ends
   c. bottom
   d. sides

7. Why should you use stranded wire for your antenna instead of solid wire?

   a. tunes better
   b. takes stress better
   c. receives better
   d. grounds better

8. What type of insulator would be best in constructing a long-wire antenna?

   a. wood
   b. wire
   c. glass
   d. plastic

9. The antenna for receiving should be kept away from objects that will cause:

   a. modulation.
   b. frequency change.
   c. interference.
   d. power loss.

10. Why do you need a grounding wire on your antenna?

    a. tunes easier
    b. better front end reception
    c. lighting protection
    d. reduces interference

File Code: 77.03.02.00.A2-1

Date Published: 11/12/75

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Learning Experience Guide

UNIT: CRYSTAL DETECTORS

RATIONALE:

One of the radio receiver sections that a service person works with is a detector circuit. There are various types of detectors, yet their functions vary among detectors making it important to understand these detector applications to the function of all detectors.

PREREQUISITES:

Unit: 77.03.01 Introduction to Radio

OBJECTIVE:

Given a basic radio text/workbook, necessary tools and equipment, identify and explain the functions of detector circuits, tuned circuits and vacuum tube diodes.

Build a radio signal detector, a tuned circuit for radio signals and a vacuum tube signal detector.

RESOURCES:

Printed Materials

Basic Radio, Part 1. Heath Company, Benton Harbor, Michigan, 1960.

Equipment

Basic Radio Kit, Heathkit Model EK-2, Heathkit Company, Benton Harbor, Michigan.
Soldering Iron.
Service Master Kit 99 SM or equivalent: Xcelite 99 SM Kit, Jenson Tools and Alloys, 4117 North 44th Street, Phoenix, Arizona.
Volt-Ohm meter.
Soldering tools.

GENERAL INSTRUCTIONS:

You have been prescribed to the second unit of this course. The activities that you perform will be assigned one at a time. A LAP will give you directions for each activity. Read the LAP and follow the procedure and directions given.

Principal Author(s): P. Hoggatt

GENERAL INSTRUCTIONS:

After completing each LAP, you are to take the LAP test, score it, and find out the reason for any missed items before beginning the next assigned LAP.

When you finish the performance activities for the unit, you will be given a unit test as stated in the "Evaluation Procedures" for post testing. After successful completion of the unit test, the next assigned unit for the course is begun.

PERFORMANCE ACTIVITIES:

.01 Fundamentals of Radio Receivers
.02 Crystal Diode Rectifiers
.03 Detector Circuits
.04 Building a Radio Signal Detector
.05 Tuned Circuits
.06 Building a Tuned Circuit for Radio Signals
.07 Vacuum Tube Diodes
.08 Building a Vacuum Tube Signal Detector

EVALUATION PROCEDURE:

When pretesting:

1. The student takes the unit multiple-choice pretest.
2. Successful completion is 4 out of 5 items for each LAP part of the pretest.
3. The student then takes a unit performance test if the unit pretest was successfully completed.
4. Satisfactory completion of the performance test is meeting the criteria listed on the performance test.

When post testing:

1. The student takes a multiple-choice unit post test and a unit performance test.
2. Successful unit completion is meeting the listed criteria for the performance test.

FOLLOW-THROUGH:

You are now ready to begin with the first LAP. If you have questions, contact your instructor.

Student: ______________________ File Code: 77.03.02.00. A2-2

Date: ______________________ Date Published: 7/29/75

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UNIT PRETEST: CRYSTAL DETECTORS

77.03.02.01.

1. What is another name for a detector section of an A.M. radio receiver?

   a. demodulator
   b. amplifier
   c. modulator
   d. tuneable detector

2. A radio detector circuit has a R.F. input signal, with an output of:

   a. A.V.C. signal.
   b. audio frequency.
   c. tuneable R.F. signal.
   d. modulated signal.

3. What kind of signal in a radio operates a speaker or earphone?

   a. audio
   b. a modulated signal
   c. I.F. signal
   d. radio frequency

4. In an A.M. radio receiver, because of more amplifiers in your R.F. and A.F. section, what is greatly improved.

   a. signal
   b. selection
   c. voice
   d. detector

5. The other function of the R.F. section of a radio receiver also does what to the signal.

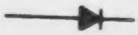
   a. modulates
   b. amplifies
   c. converts
   d. demodulates

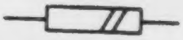
77.03.02.02.

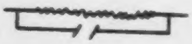
6. Heat will damage a crystal diode. So when soldering, what can you use to prevent any damage?

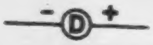
   a. low heat solder
   b. heat sink
   c. screw driver
   d. low-wattage iron

7. Of the following symbols, which one is used in a schematic for a germanium diode:

   a. 

   b. 

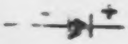
   c. 

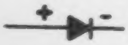
   d. 

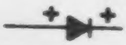
8. A crystal diode is considered a one-way device. One way it is a good conductor, the other way it isn't. This is also true when referring to:

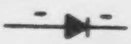
   a. power.
   b. heat.
   c. voltage.
   d. sound.

9. Which one of the following illustrations is correct?

   a. 

   b. 

   c. 

   d. 

10. What is the material inside the glass envelope of a signal crystal diode?

   a. connecting lead
   b. gas
   c. germanium
   d. selenium

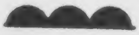
77.03.02.03

11. What helps complete the transformation from modulated R.F. signal to an audio frequency by eliminating any R.F. signal in the detector circuit.

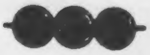
    a. demodulation
    b. detection
    c. amplification
    d. filtering

12. Which of the following diagrams represents a rectified signal in a radio receiver?

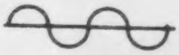
    a.



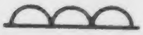
    b.



    c.



    d.



13. The effect of the speaker slurring from one R.F. peak to another is called:

    a. sine-wave.
    b. modulation.
    c. distortion.
    d. filtering.

14. What is the main function of a detector in an A.M. radio receiver?

    a. modulates the signal
    b. front to back ratio
    c. translates A.F. to R.F.
    d. translates R.F. to A.F.

15. Distortion in an A.M. radio receiver is defined as:

    a. the amount of amplification during detection.
    b. the difference between reproduced sound and original sound transmitted.
    c. both a and b correct.
    d. can be completely eliminated in electronic circuits.

77.03.02.04.

16. What is the value of a resistor if it has a color code of red, red, red, gold?

    a. 220 5%
    b. 2.2 10%
    c. 2200 5%
    d. 330 5%

17. What material is the crystal in an earphone constructed of?

    a. mineral
    b. carbon
    c. quartz
    d. glass

18. Why do we need a detector in a radio receiver?

    a. the A.F. signal will cancel out
    b. to get sound
    c. to feed a signal into an audio AMP
    d. to produce an I.F. signal

19. What in the voice coil of a speaker or earphone is placed to cause the voice coil to move back and forth?

    a. A.F. signal
    b. crystal
    c. cabinet
    d. permanent magnet

20. How many radio stations should you get at Glasgow A.F.B., Montana on a simple detection circuit?

    a. 3
    b. 1
    c. 2
    d. 4

77.03.02.05.

21. What is the term used in a radio receiver when it is referred to as tuned circuit?

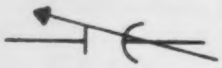
    a. resonant
    b. I.F. rejection
    c. selectivity
    d. proper frequency

22. The closer the plates are in a capacitor, the higher the:

    a. working volts.
    b. capacity.
    c. resistance.
    d. frequency.

23. This symbol stands for a:

    a. variable resistor.
    b. capacitor.
    c. transistor.
    d. variable capacitor.



24. The main factors in determining a capacitor's size are the distance between the plate and the:

    a. area of the plate.
    b. size of the capacitor.
    c. size of the charge.
    d. the size of the inductor.

25. The inductance of a coil is measured in:

    a. OHMS.
    b. inductive reactance.
    c. henrys.
    d. reluctance.

77.03.02.06.

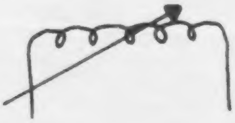
26. What is the value of measurement in a coil measured in a tuned circuit?

    a. farads
    b. OHMS
    c. inductance
    d. henrys

27. When building a tuner circuit for a radio, or when handling the stator capacitor, why must you handle the capacitor with care?

    a. fingerprints will ruin it
    b. the middle stator is made of very soft metal
    c. static electricity will build on it
    d. so you don't bend it

28. The following symbol represents a:



    a. potuntometer.
    b. variable coil.
    c. variable resistor.
    d. variable capacitor.

29. In a tuned radio, what stimulates the circuit at resonant frequency so it won't die out?

    a. capacitor
    b. power supply
    c. inductor
    d. antenna

30. Which plates are insulated from the capacitor frame, but have an electrical connection to ground in a radio tuned circuit.

    a. stator
    b. rotar
    c. resonant
    d. coil

77.03.02.07.

31. With respect to each other, what is the polarity of the cathode and the plate used as a rectifier in a receiver?

a. both plate and cathode are positive
b. both plate and cathode are negative
c. cathode negative, plate positive
d. plate negative, cathode positive

32. The plate of a diode tube does what to the electrons coming from the cathode when put in practical application.

a. attracts them
b. heats them
c. repels them
d. ionizes them

33. Does the filament of a vacuum tube have any relation to how much current will conduct in a tube?

a. yes, it regulates how much temperature is put on the cathode
b. only if it is connected to the cathode
c. yes, if it is also heating the plate
d. no

34. What are the two elements that you will find in a diode type tube to make it function?

a. mercury gas and cathode
b. ion gas and plate
c. grid and filament
d. plate and cathode

35. Why must a cathode of a receiving tube diode be heated to operate?

a. to raise the resistance
b. to emit electrons
c. to lower the resistance
d. to heat the plate

77.03.02.08.

36. What are the pin numbers on a 7 pin triode that your filament power is applied to?

a. 2 and 3
b. 1 and 7
c. 6 and 7
d. 4 and 5

37. What condition must be met in addition to having a vacuum before electrons from a battery can flow through a diode vacuum tube?

a. addda grid
b. apply grid voltage
c. get a battery with a high power output
d. heating the cathode

38. The pins of a tube are numbered from 1 to 9 in what direction, starting at the wide space on the tube base.

a. straight up and down
b. diagonal
c. counterclockwise
d. clockwise

39. When wiring tube socket pins to the grounded center shield, what kind of wire do you use?

a. bare
b. grounding strap
c. insulated
d. copper insulated

40. What happens when you apply too much heat to components when soldering?

a. you reduce their tolerance
b. you get solder on everything
c. you ruin heat sinks
d. you ruin them

UNIT PRETEST ANSWER KEY: CRYSTALS DETECTORS

LAP		
01	1.	A
	2.	B
	3.	A
	4.	B
	5.	B
02	6.	B
	7.	A
	8.	C
	9.	A
	10.	C
03	11.	D
	12.	A
	13.	D
	14.	D
	15.	B
04	16.	C
	17.	A
	18.	A
	19.	D
	20.	B
05	21.	A
	22.	B
	23.	D
	24.	A
	25.	C
06	26.	D
	27.	D
	28.	B
	29.	D
	30.	A
07	31.	C
	32.	A
	33.	D
	34.	D
	35.	B
08	36.	D
	37.	D
	38.	D
	39.	A
	40.	D

File Code: 77.03.02.01.A2-0

Date Published: 11/12/75

Mountain-Plains Education &
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Glasgow AFB, Montana 59231

Learning Activity Package

Student: ______________________

Date: ______________________

PERFORMANCE ACTIVITY: Functions of Radio Receivers

OBJECTIVE:

Identify terms commonly used to describe the functions and effects of radio receivers.

EVALUATION PROCEDURE:

Successfully complete at least 80% of the items on a multiple-choice test about this LAP.

RESOURCES:

Basic Radio, Part 1, Heath Company.

PROCEDURE:

1. Read pages 15-17 in Basic Radio (Part 1).
2. Take the LAP test.

Principal Author(s): P. Schuster

LAP TEST ANSWER KEY: FUNCTIONS OF RADIO RECEIVERS

1. B
2. B
3. C
4. B
5. B
6. C
7. A
8. A
9. A
10. D

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File Code: 77.03.02.02.A2-0

Date Published: 11/12/75

Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Crystal Diode Rectifiers

OBJECTIVE:

Determine the effect a crystal rectifier has on an applied DC voltage.

EVALUATION PROCEDURE:

Successfully complete at least 80% of the items on a multiple-choice test about this LAP.

RESOURCES:

Basic Radio, Part 1, Heath Company.
Heath Kit, EK - 2A.

Volt-ohm meter.
2 - 1½ volt cells.

PROCEDURE:

1. Read pages 17-20 in Basic Radio, (Part 1).
2. Perform the experiments following the procedures found on pages 17-19.
3. Answer questions on page 20, on another sheet of paper.
4. Check answers with answer key on page 84.
5. Take the LAP test.

Principal Author(s): P. Schuster

LAP TEST ANSWER KEY: CRYSTAL DIODE RECTIFIERS

1. C
2. A
3. B
4. B
5. B
6. A
7. C
8. D
9. B
10. B

File Code: 77.03.02.03.A2-0

Date Published: 11/12/75

Mountain-Plains Education &
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Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Detector Circuits

OBJECTIVE:

Identify terms commonly used to describe detector circuitry in a radio receiver.

EVALUATION PROCEDURE:

Successfully complete at least 80% of the items on a multiple-choice test about this LAP.

RESOURCE:

Basic Radio, Part 1, Heath Company.

PROCEDURE:

1. Read pages 21 and 22 in Basic Radio (Part 1).
2. Take the LAP test.

Principal Author(s): P. Schuster

LAP TEST ANSWER KEY: DETECTOR CIRCUITS

1. A
2. D
3. B
4. B
5. D
6. D
7. B
8. B
9. A
10. A

File Code: 77.03.02.04.A2-0

Date Published: 11/12/75

Mountain-Plains Education &
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Glasgow AFB, Montana 59231

Learning Activity Package

Student: ______________________

Date: ______________________

PERFORMANCE ACTIVITY: Building a Radio Signal Detector

OBJECTIVE:

Given parts, equipment and supplies, assemble a radio signal detector according to the manufacturer's specifications and following procedures described in the text Basic Radio, Part 1.

EVALUATION PROCEDURE:

Assembly is evaluated at the end of this unit.

Successfully complete at least 80% of the items on a multiple-choice test about this LAP.

RESOURCES:

Basic Radio, Part 1, Heath Company.
Heath Kit EK- 2A.

Hand tools.
Soldering iron.
Soldering tools.

PROCEDURE:

1. Read about "How to Build a Radio Signal Detector" beginning on page 23 in Basic Radio, Part 1.
2. Assemble the radio signal detector using procedures described on pages 23-26.
   KEY POINT: Use a heat sink when soldering the crystal diode.
3. On a separate sheet of paper, answer the questions on page 27.
4. Check answers with answer key on page 84.
5. Take the LAP test.

Principal Author(s):

P. Schuster

LAP TEST ANSWER KEY: BUILDING A RADIO SIGNAL DETECTOR

1. B
2. A
3. B
4. D
5. A
6. C
7. B
8. A
9. B
10. C

File Code: 77.03.02.05.A2-0

Date Published: 11/12/75

Mountain-Plains Education &
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Glasgow AFB, Montana 59231

Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Tuned Circuits

OBJECTIVE:

Identify terms commonly used in the industry to describe tuned circuits and the various components contained therein.

EVALUATION PROCEDURE:

Successfully complete at least 80% of the items on a multiple-choice test about this LAP.

RESOURCES:

Basic Radio, Part 1, Heath Company.

PROCEDURE:

1. Read pages 28-34 in Basic Radio (Part 1).
2. Take the LAP test.

Principal Author(s): P. Schuster

LAP TEST ANSWER KEY: TUNED CIRCUITS

1. B
2. A
3. B
4. A
5. B
6. D
7. B
8. D
9. D
10. A

File Code: 77.03.02.06.A2-0

Date Published: 11/12/75

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Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Building a Tuned Circuit for Radio Signals

OBJECTIVE:

Given parts, equipment and supplies, assemble a tuned circuit according to the manufacturer's specifications and following procedures described in the text Basic Radio, Part 1.

EVALUATION PROCEDURE:

Assembly is evaluated at the end of this unit.

Successfully complete at least 80% of the items on a multiple-choice test about this LAP.

RESOURCES:

Basic Radio, Part 1, Heath Company.
Heath Kit EK - 2A.

Hand tools.
Soldering iron.
Soldering tools.

PROCEDURE:

1. Read pages 34-39 in Basic Radio (Part 1).
2. Build a tuned circuit following the stages on pages 36-37.
3. Answer questions on page 39.
4. Check answers with the answer key on page 85.
5. Take the LAP test.

Principal Author(s): P. Schuster

LAP TEST ANSWER KEY: BUILDING A TUNED CIRCUIT FOR RADIO SIGNALS

1. A
2. B
3. A
4. A
5. C
6. B
7. C
8. C
9. B
10. A

File Code: 77.03.02.07.A2-0

Date Published: 11/12/75

Mountain-Plains Education &
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Glasgow AFB, Montana 59231

Learning Activity Package

Student: ______________________

Date: ______________________

PERFORMANCE ACTIVITY: Vacuum Tube Diodes

OBJECTIVE:

Identify terms used to describe the functions and operations of vacuum tube diodes contained in radio receivers.

EVALUATION PROCEDURE:

Successfully complete at least 80% of the items on a multiple-choice test about this LAP.

RESOURCES:

Basic Radio, Part 1, Heath Company.

PROCEDURE:

1. Read pages 40-42 in Basic Radio (Part 1).
2. Take the LAP test.

Principal Author(s): P. Schuster

LAP TEST ANSWER KEY: VACUUM TUBE DIODES

1. A
2. B
3. C
4. A
5. B
6. B
7. A
8. A
9. D
10. A

File Code: 77.03.02.08.A2-0

Date Published: 11/12/75

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Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Building a Vacuum Tube Signal Detector

OBJECTIVE:

Given parts, equipment, and supplies, assemble a vacuum tube signal detector according to the manufacturer's specifications described in the text Basic Radio, Part 1.

EVALUATION PROCEDURE:

Assembly is evaluated at the end of this unit.

Successfully complete at least 80% of the items on a multiple-choice test about this LAP.

RESOURCES:

Basic Radio, Part 1, Heath Company.
Heath Kit EK - 2A.

Hand tools.
Soldering iron.
Soldering tools.
Volt-ohm meter.

PROCEDURE:

1. Read "How to Build a Vacuum Tube Signal Detector" beginning on page 43 in Basic Radio (Part 1).
2. Build the Signal Detector following steps on pages 46-50.
3. Answer questions on page 51.
4. Check answers with the answer key on page 85.
5. Take the LAP test.

Principal Author(s): P. Schuster

LAP TEST ANSWER KEY: BUILDING A VACUUM TUBE SIGNAL DETECTOR

1. C
2. B
3. B
4. A
5. A
6. C
7. B
8. D
9. C
10. C

Student: ____________ File Code: 77.03.02.00. B2-2

Date: ____________ Date Published: 7/29/75

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UNIT POST TEST: CRYSTAL DETECTORS

77.03.02.01.

1. What section of a radio receiver immediately follows the R.F. section?

   a. audio frequency section
   b. detector section
   c. tuner
   d. antenna

2. In a radio receiver, in order to detect a signal it has to be:

   a. tuneable.
   b. audio frequency.
   c. modulated.
   d. rectified.

3. What section in an A.M. radio receiver follows the detector circuit?

   a. A.F. section
   b. speaker
   c. R.F. section
   d. I.F. section

4. What is one of the two functions that the R.F. section of a radio performs?

   a. modulates it
   b. detects it
   c. selects one signal
   d. converts it to an audio signal

5. The broadcast signal, when it reaches the detector, is exactly the same except it is the only signal and:

   a. modulated.
   b. demodulated.
   c. detected.
   d. amplified.

77.03.02.02.

6. When making a backward OHM meter reading of a germanium diode, which end does your positive lead of meter connect to?

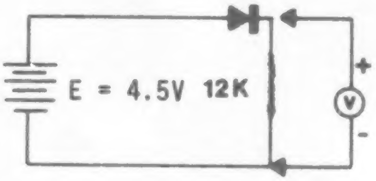
   a. banded end
   b. both ends at once
   c. the banded end with a low resistance reading
   d. clear end

7. A.C. current that has been rectified in a radio chassis becomes ____at the output of your rectifier.

   a. R.F. signal
   b. D.C.
   c. pulsating A.C.
   d. pulsating D.C.

8. What is your meter reading from the following schematic?

   a. 4.5V
   b. -4.5V
   c. 12V
   d. 0V



9. Why is it in a crystal diode, current will flow in only one direction?

   a. high front resistance
   b. high back resistance
   c. high resistance both ways
   d. low resistance both ways

10. What did they call a germanium diode back when radio was first started?

   a. rectifier.
   b. cat whisker.
   c. transistor.
   d. a capacitor.

77.03.02.03.

11. A good substitute for a diode when used in a detector circuit of a radio receiver is:

    a. volume control.
    b. a coil.
    c. transistor.
    d. a capacitor.

12. Two functions involved in the detection of a R.F. signal in an A.M. radio chassis are rectification and:

    a. filtering.
    b. modulation.
    c. pulsating.
    d. amplification.

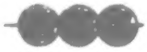
13. What device would you use to extort the audio signal from a modulated broadcast signal?

    a. amplifier
    b. crystal diode
    c. tuner
    d. modulator

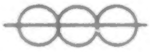
14. Audio detection in a superheterodyne radio receiver occurs where in a radio?

    a. preceding the I.F. AMP
    b. antenna circuit
    c. preceding the audio amplifier
    d. following the audio AMP

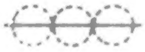
15. Which signal constitutes a R.F. modulated signal after it comes through the R.F. AMP in a radio receiver?

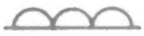
    a. 

    b.

    c.

    d. 

77.03.02.04.

16. Does the polarity of a diode have any effect on the detection process in an A.M. radio chassis?

    a. yes
    b. only the signal polarity
    c. no
    d. only the voltage polarity

17. The input to your audio detector in an A.M. radio chassis comes from what section?

    a. R.F. AMP
    b. tuner
    c. AVC section
    d. A.F. section

18. Which of the following will vibrate, if properly sized and shaped and placed within an audio signal or a small voltage.

    a. crystals
    b. speaker
    c. capacitors
    d. diodes

19. What is the element that changes electrical vibration into mechanical vibration.

    a. modulator
    b. crystal
    c. capacitor
    d. diode

20. An earphone or loudspeaker in a detector responds only to the changes in:

    a. tone.
    b. temperature.
    c. amplitude.
    d. size.

77.03.02.05.

21. In a variable capacitor, usually the ones used in a radio receiver, what is used as an insulator between the rotar plates and stator plates?

    a. paper
    b. electrolytes
    c. air
    d. foil

22. Will current flow through a capacitor?

    a. no
    b. yes, at resonant frequency
    c. no, it is a closed circuit
    d. yes

23. A charge on a capacitor will stay indefinitely until what is placed across its plate.

    a. battery
    b. another
    c. power source
    d. circuit

24. 1000 microfarads are equal to how many farads?

    a. .000,001 farads
    b. 1,000,000 farads
    c. .001 farads
    d. .000,000,001 farads

25. What is the unit of capacitance?

    a. henrys
    b. farads
    c. watts
    d. ohms

77.03.02.06.

26. Capacity between the antenna and earth, that might disturb tuned circuit action, is minimized by connecting which of the following in series with antenna.

    a. resistor
    b. detector coil
    c. inductor
    d. capacitor

77.03.02.06. continued:

27. To tune a circuit, you change the value of:

    a. resistance.
    b. frequency.
    c. resistance.
    d. capacitance.

28. When the variable capacitor plates, in a tuned circuit, are all the way unmeshed, the resonant frequency is:

    a. lower.
    b. higher.
    c. falls to zero.
    d. remains the same.

29. What frequency characteristic of a coil that influences a kick-back action in capacitor used in the circuit.

    a. oscillating
    b. resonant
    c. reactance
    d. synchronized

30. The electrical characteristic of a coil that influences a kick-back action in a tuned radio circuit is called:

    a. reluctance.
    b. reactance.
    c. resistance.
    d. inductance.

77.03.02.07.

31. What is the proper name of the device in a vacuum tube diode that raises the temperature inside?

    a. plate
    b. cylinder oven
    c. filament
    d. cathode

32. When the voltage in the cathode of a tube diode becomes highly positive and the plate becomes highly negative, the tube:

    a. ionizes.
    b. conducts.
    c. shorts.
    d. opens.

77.03.02.07. continued:

33. When you heat a cathode of a diode tube, or any other tube, what do you call the electron drift between the cathode and plate?

    a. emission
    b. ionizing
    c. vacuum charge
    d. space charge

34. What is the best way to check a diode tube when it is out of circuit?

    a. tube checker
    b. you can't, you check it in the circuit
    c. ohm meter
    d. voltmeter

35. Why must there be a vacuum inside a tube when used as a diode in a radio receiver?

    a. to keep the plate cold
    b. to keep the filament from burning up
    c. to keep the cathode hot
    d. to reduce the secondary emission

77.03.02.08.

36. The element of spiral wires positioned between the cathode and the plate in a vacuum tube is called the:

    a. pentode.
    b. tetrode.
    c. heater.
    d. grid.

37. What is a common mistake a person will make when soldering a component?

    a. not enough solder
    b. too much heat
    c. crimping wire
    d. too much solder

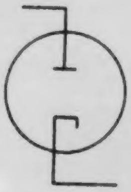
38. What do you call a receiving vacuum tube that contains three elements?

    a. triode
    b. diode
    c. pentode
    d. duo-diode

77.03.02.08. continued:

39. The following pictorial schematic is from which kind of tube?

    a. triode
    b. pentode
    c. duo-diode
    d. diode



40. What part of the tube socket is grounded by being in contract with one of the tube socket screws.

    a. filament
    b. socket
    c. center shield
    d. pin

UNIT FOST TEST ANSWER KEY: CRYSTAL DETECTORS

LAP		
01	1.	B
	2.	D
	3.	A
	4.	C
	5.	D
02	6.	D
	7.	D
	8.	A
	9.	B
	10.	B
03	11.	C
	12.	A
	13.	B
	14.	C
	15.	A
04	16.	A
	17.	B
	18.	A
	19.	B
	20.	C
05	21.	C
	22.	A
	23.	D
	24.	C
	25.	B
06	26.	D
	27.	D
	28.	A
	29.	B
	30.	D
07	31.	C
	32.	D
	33.	A
	34.	A
	35.	B
08	36.	D
	37.	B
	38.	A
	39.	D
	40.	C

Student: ______________________ File Code: 77.03.02.00.A1-5

Date: ______________________ Date Published: 11-14-74

Family Pay Number: __________ Sex: M F (Circle 1)

Mountain-Plains Education &
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Glasgow AFB, Montana 59231

UNIT PERFORMANCE TEST: CRYSTAL DETECTORS

OBJECTIVE:

Given parts (Heathkit ER-2A), equipment and supplies, assemble a vacuum tube signal detector according to the manufacturer's specifications described in the text Basic Radio, Part 1, page 21-50.

TASK:

The student will be given components and tools to assemble **a radio signal detector**.

ASSIGNMENT:

CONDITIONS:

The student will be tested in an environment similar to that of a radio-TV repair shop. He will be supplied with the same tools and materials normally available to radio-TV service persons. He may receive no assistance from the instructor or from students.

RESOURCES:

Basic Radio, Part 1, Heathkit Co., 1961.

Heathkit, Model EK-2A, Heath Co., 1961.

Soldering iron, needle nose pliers, nut driver set, screw drivers, slip joint pliers.

Mountain-Plains Education &
Economic Development
Program, Inc.
Glasgow AFB, Montana 59231

Student: ______________________

Date: ______________________

File Code: 77.03.02.00.A1-5

Date Published: 11-14-74

Family Pay Number: ______________ Sex: M F (Circle 1)

PERFORMANCE CHECKLIST:

OVERALL PERFORMANCE: Satisfactory_____ Unsatisfactory_____

	CRITERION	
	Met	Not Met
Objective 1:		
1. Proper solder techniques.		
Criterion: Basic Radio, Part 1 page VIII.		
2. Proper placement of components.		
Criterion: Basic Radio, Part 1, page 48.		
3. Proper wiring installed.		
Criterion: Basic Radio, Part 1, page 48.		
4. Tubes and lamp light when voltage is applied.		
Criterion: Basic Radio, Part 1, page 49.		
5. Successful completion of the circuit evaluation.		
Criterion: Basic Radio, Part 1, page 49.		
6. Follows safety procedures.		
Criterion: Basic Radio, Part 1, page 49.		
7. Temporary type lap joints used when applicable.		
Criterion: Basic Radio, Part 1, page 47.		

(Checklist continued)

	CRITERION	
	Met	Not Met
8. Test completed in allotted time.		
Criterion: Doesn't exceed 6 hours.		
Student must meet criterion of five line items to obtain an over-		
all score of satisfactory.		

Student: ______________________ File Code: 77.03.02.01. A2-2

Date: ______________________ Date Published: 8/6/74

Mountain-Plains Education &
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Glasgow AFB, Montana 59231

LAP TEST: FUNCTIONS OF RADIO RECEIVERS

1. What is another name for a detector section of an A.M. radio receiver?

   a. amplifier
   b. demodulator
   c. tuneable detector
   d. modulator

2. The broadcast signal, when it reaches the detector, is exactly the same except it is the only signal and:

   a. detected.
   b. amplified.
   c. modulated.
   d. demodulated.

3. Why won't a modulated signal being sent as a broadcast signal operate a speaker?

   a. has to be a R.F. signal to operate a speaker
   b. needs an antenna
   c. has to be amplified
   d. has to be demodulated

4. In a radio receiver, in order to detect a signal it has to be:

   a. tuneable.
   b. rectified.
   c. modulated.
   d. audio frequency.

5. What do you call the function in a radio when it transforms modulated radio frequency signal into audio signal?

   a. to amplify
   b. to detect
   c. to modulate
   d. to demodulate

6. What kind of signal in a radio operates a speaker or earphone?

   a. a modulated signal
   b. I.F. signal
   c. audio
   d. radio frequency

7. What kind of operation must be performed on the incoming signal if it is to be restored to its original audio form?

   a. decoding
   b. amplified
   c. modulated
   d. tuned

8. What section of a radio receiver immediately follows the R.F. Amp. section?

   a. detector section
   b. tuner
   c. audio frequency section
   d. antenna

9. The R.F. section of a radio receiver does which of the following to the signal?

   a. amplifies it
   b. modulates it
   c. converts it
   d. demodulates it

10. A radio detector circuit has a R.F. input signal, with an output of:

   a. modulated signal.
   b. A.V.C. signal.
   c. tuneable R.F. signal.
   d. audio frequency.

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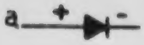
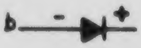
LAP TEST: CRYSTAL DIODE RECTIFIERS

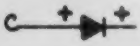
1. If you are reading the resistance of germanium diode, and you are making a "forward" resistance check, which end of the diode is your positive lead from your ohm meter placed on?

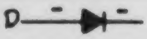
   a. banded end, on the high resistance side of the ohm meter
   b. banded end
   c. non-banded end
   d. both meter leads on both ends

2. Which one of the following illustrations is correct?









   a.

   b.

   c.

   d.

3. You are using an ohm meter to measure the resistance of a diode and your reading is 150K, which way are you reading?

   a. front to front
   b. backward
   c. forward
   d. back to back

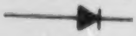
4. You are using an ohm meter to check the resistance of germanium diode and you have a reading of 200 ohms. Which way are you reading?

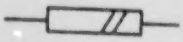
   a. back to back
   b. forward
   c. front to front
   d. backward

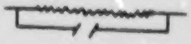
5. A.C. current that has been rectified in a radio chassis becomes what at the output of your rectifier.

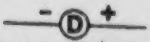
   a. R.F. signal
   b. pulsating D.C.
   c. D.C.
   d. pulsating A.C.

6. Of the following symbols, which one is used in a schematic for a germanium diode:

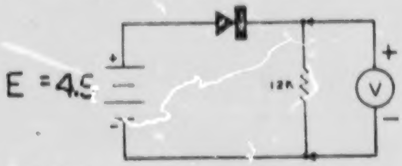
a. 

b. 

c. 

d. 

7. What is your meter reading from the following schematic?



a. 12V
b. -4.5V
c. 4.5V
d. 0V

8. A crystal diode is considered a one-way device. One way it is a good conductor, the other way it isn't. This is also true when referring to:

a. power.
b. sound.
c. heat.
d. voltage.

9. Is there any voltage drop across a signal diode?

a. yes, it is 1.41 x peds value
b. no
c. yes
d. no, unless you use pure D.C.

10. What did they call a germanium diode back when radio was first started?

a. crystal
b. cat whisker
c. rectifier
d. power tube

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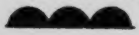
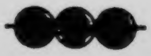
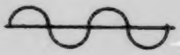
LAP TEST: DETECTOR CIRCUITS

1. Which of the following diagrams represents a rectified signal in a radio receiver?

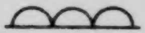


a.

b. 

c. 

d.



2. The effect of the speaker slurring from one R.F. peak to another is called:

   a. modulation.
   b. sine-wave.
   c. distortion.
   d. filtering.

3. What device would you use to extort the audio signal from a modulated broadcast signal?

   a. tuner
   b. crystal diode
   c. modulator
   d. amplifier

4. Which signal in an A.M. radio receiver causes your speaker to operate?

   a. tuned frequency
   b. audio frequency
   c. rectified
   d. radio frequency

5. What helps complete the transformation from modulated R.F. signal to an audio frequency by eliminating any R.F. signal in the detector circuit.

   a. amplification
   b. detection
   c. demodulation
   d. filtering

6. The main step in extracting the audio signal from a modulated broadcast signal is to:
   - a. amplify it.
   - b. modulate it.
   - c. tune it.
   - d. rectify it.

7. When you use a radio amplifier in a radio chassis, what can you use for a filter to screen out R.F. spikes?
   - a. low-pan filter
   - b. R.C. network
   - c. R.L. network
   - d. P.T. network

8. What would be another term for the amount of modulation signal which is being received in an A.M. radio?
   - a. frequency
   - b. amplitude
   - c. amplified
   - d. swells

9. Two functions involved in the detection of a R.F. signal in an A.M. radio chassis are rectification and:
   - a. filtering.
   - b. pulsating.
   - c. modulation.
   - d. amplification.

10. If a diode is used for detection in a radio receiver, it is most likely to be:
   - a. germanium.
   - b. NPN.
   - c. PNP.
   - d. silicon.

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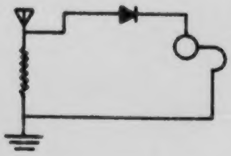
LAP TEST: BUILDING A RADIO SIGNAL DETECTOR

1. What is the problem with this detector circuit?

   a. shouldn't be grounded
   b. diode in backwards
   c. no power supply
   d. ant is wrong



2. The most common device used for a detector is:

   a. diode.
   b. amplifier.
   c. capacitor.
   d. transistor.

3. Rectification is a term used to indicate that an alternating voltage passes through some devices that allow only one-half of the alternating cycle to flow. Rectification may be used to indicate what happens in detection but where is it most often used?

   a. I.F. amplifier circuit
   b. power supply circuit
   c. audio circuit
   d. antenna input circuit

4. The input to your detector in an A.M. radio chassis comes from what section?

   a. A.F. section
   b. AVC section
   c. tuner
   d. I.F. amp

5. What is the value of a resistor if it has a color code of red, red, red, gold?

   a. 2200 5%
   b. 330 5%
   c. 2.2 10%
   d. 220 5%

6. What is the element that changes electrical vibration into mechanical vibration.

   a. tube
   b. modulator
   c. crystal
   d. capacitor

7. Does the polarity of a diode have any effect on the detection process in an A.M. radio chassis?

   a. only the voltage polarity
   b. yes
   c. no
   d. only the signal polarity

8. What in the voice coil of a speaker or earphone is placed in so it will move back and forth?

   a. permanent magnet
   b. A.F. signal
   c. cabinet
   d. crystal

9. How many radio stations should you get here on a simple detection circuit?

   a. 2
   b. 1
   c. 3
   d. 4

10. In the construction of your signal detector, if your radio is real weak, will lengthening of your antenna help or reversing the diode?

   a. changing the diode
   b. lengthening the antenna
   c. neither one
   d. both of them will help

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LAP TEST: TUNED CIRCUITS

1. What is the inductance of a coil measured in?

   a. ohms
   b. henrys
   c. reluctance
   d. inductive reactance

2. What is the unit of capacitor?

   a. farads
   b. henrys
   c. ohms
   d. watts

3. What is the term used in a radio receiver when it is referred to as tuned circuit?

   a. selectivity
   b. resonant
   c. I.F. rejection
   d. proper frequency

4. 1000 microfarads is equal to how many farads?

   a. .001 farads
   b. .000,000,001 farads
   c. 1,000,000 farads
   d. .000,001 farads

5. In a variable capacitor, usually the ones used in a radio receiver, what is used as an insulator?

   a. electrolytes
   b. air
   c. foil
   d. paper

6. Will current flow through a capacitor?

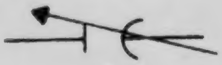
   a. yes, at resonant frequency
   b. no, it is an open circuit
   c. yes
   d. no

7. When a length of wire is spiralled into a series of circular loops or turns it is referred to as a:

   a. spiral circuit transformer.
   b. coil.
   c. RL circuit
   d. transformer

8. This symbol stands for a:

   a. variable resistor.
   b. capacitor.
   c. transistor.
   d. variable capacitor.



9. A charge on a capacitor will stay indefinitely until which of the following is placed across its plate.

   a. battery
   b. power source
   c. another condenser
   d. circuit

10. The main factors in determining a capacitor's size are the distance between the plate and the:

   a. area of the plate.
   b. size of the charge.
   c. size of the capacitor.
   d. the size of the inductor.

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LAP TEST: BUILDING A TUNED CIRCUIT FOR RADIO SIGNALS

1. What is the value of measurement in a coil measured in a tuned circuit?

   a. henrys
   b. ohms
   c. farads
   d. inductance

2. Capacity between the antenna and earth, that might disturb tuned circuit action, is minimized by connecting which of the following in series with an antenna.

   a. resistor
   b. capacitor
   c. detector coil
   d. inductor

3. The electrical characteristic of a coil that influences a kick-back action in a tuned circuit is called:

   a. inductance.
   b. reluctance.
   c. resistance.
   d. reactance.

4. What winding is used in a tuned circuit on the regenerative detector coil for keeping your oscillator running?

   a. secondary winding
   b. primary winding
   c. tickler through primary winding
   d. tickler winding

5. When the kick-back of a capacitor is combined properly with the kick-back of a coil, you have what kind of action.

   a. physical resonance
   b. pulse frequency
   c. oscillating
   d. synchronized

6. **Which frequency of a tuned circuit depends on the value of the coil and capacitor used in the circuit.**

   a. synchronized
   b. resonant
   c. reactance
   d. oscillating

7. **Which plates are insulated from the capacitor frame, but have an electrical** connection to ground in a radio tuned circuit.

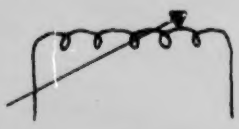
   a. rotar
   b. resonant
   c. stator
   d. coil

8. To tune a circuit, you change the value of:

   a. frequency.
   b. resonant.
   c. capacitance.
   d. resistance.

9. The following symbol represents a:

   a. potuntometer.
   b. variable coil.
   c. variable capacitor.
   d. variable resistor.



10. If either the coil or capacitor is made larger, the resonant frequency of the circuit:

   a. decreases.
   b. stays the same.
   c. increases.
   d. goes to zero.

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LAP TEST: VACUUM TUBE DIODES

1. With respect to each other, what is the polarity of the cathode and the plate used as a rectifier in a receiver?

   a. cathode negative, plate positive
   b. both plate and cathode are negative
   c. plate negative, cathode positive
   d. both plate and cathode are positive

2. A vacuum tube used as a rectifier in an A.M. radio chassis can also be called what kind of current device.

   a. high resistance
   b. one-way
   c. low
   d. high

3. Why must a cathode of a receiving tube diode be heated to operate?

   a. to heat the plate
   b. to lower the resistance
   c. to emit electrons
   d. to raise the resistance

4. When using a schematic, the heater circuit might be left out of the symbol for a tube in a radio receiver. Why?

   a. simplicity
   b. the publisher thinks it is unnecessary
   c. too crowed
   d. the heater is outside of the tube anyway

5. When the voltage in the cathode of a tube diode becomes highly positive and the plate becomes highly negative, the tube:

   a. conducts.
   b. opens.
   c. ionizes.
   d. shorts.

6. When you heat a cathode of a diode tube, or any other tube, what do you call the electron drift between the cathode and plate?

   a. space charge
   b. emission
   c. ionizing
   d. vacuum charge

7. What are the two elements that you will find in a diode type tube to make it function?

   a. plate and cathode
   b. ion gas and plate
   c. grid and filament
   d. mercury gas and cathode

8. What is the best way to check a diode tube when it is out of circuit?

   a. tube checker
   b. you can't, you need it in the circuit
   c. voltmeter
   d. ohm meter

9. Does the filament of a vacuum tube have any relation to how much current will conduct in a tube?

   a. only if it is connected to the cathode
   b. yes, if it is also heating the plate
   c. yes, it regulates how much temperature is put on the cathode
   d. no

10. What is a principle advantage of a crystal diode used as a rectifier compared to a tube for the same purpose?

   a. no filaments
   b. higher peak to peak voltage
   c. higher heat
   d. higher peak inverse voltage

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LAP TEST: BUILDING A VACUUM TUBE SIGNAL DETECTOR

1. When wiring tube socket pins to the grounded center shield, what kind of wire do you use?

   a. copper insulated
   b. grounding strap
   c. bare
   d. insulated

2. When you connect the grid of a triode to the plate of the same tube, the tube acts like a:

   a. no change.
   b. diode.
   c. duo-triode.
   d. duo-diode.

3. Where would you get your 6.3 vac to power your filaments in your triode tube?

   a. diode tube
   b. power transformer
   c. on-off switch
   d. rectifier

4. What is a common mistake a person will make when soldering a component?

   a. too much heat
   b. too much solder
   c. not enough solder
   d. crimping wire

5. What condition must be met in addition to having a vacuum before electrons from a battery can flow through a diode vacuum tube?

   a. heating the cathode
   b. adding a grid
   c. applying grid voltage
   d. getting a battery with a high power output

6. The pins of a tube are numbered from 1 to 9 in which direction, starting at the wide space on the tube base.

   a. counterclockwise
   b. straight up and down
   c. clockwise
   d. diagonal

7. What happens when you apply too much heat to components when soldering?

   a. you ruin heat sinks
   b. you ruin them
   c. you reduce their tolerance
   d. you get solder on everything

8. The element of spiral wires positioned between the cathode and the plate in a vacuum tube is called the:

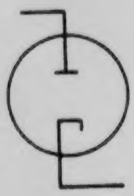
   a. pentode.
   b. heater.
   c. tetrode.
   d. grid.

9. What do you call a receiving vacuum tube that contains three elements?

   a. pentode.
   b. diode.
   c. triode.
   d. duo-diode.

10. The following pictorial schematic is for which kind of tube?

   a. triode
   b. pentode
   c. diode
   d. duo-diode



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Learning Experience Guide

UNIT: REGENERATIVE RECEIVERS

RATIONALE:

Another radio receiver section is a detector-amplifier. Understanding how circuits amplify and select are necessary to establishing alignment and troubleshooting procedures for "front end" sections.

PREREQUISITES:

Unit: 77.03.02 Crystal Detectors

OBJECTIVE:

Given a basic radio text/workbook, necessary tools and equipment, identify what a vacuum tube can do, how feedback is used for extra amplification, and build a vacuum tube amplifier, a detector amplifier, and a regenerative detector-amplifier.

RESOURCES:

Printed Materials

Basic Radio, Part 1, Heath Company, Benton Harbor, Michigan, 1960.

Equipment

Basic Radio Kit, Heathkit Model EK-2, Heathkit Company, Benton, Harbor, Michigan.
Desoldering iron.
Soldering iron.
Service Master Kit 99 SM or equivalent, Xcelite 99 SM Kit, Jenson Tools and Alloys, 4117 North 44th Street, Phoenix, Arizona.
Volt ohm meter.
Soldering Tools.

GENERAL INSTRUCTIONS:

You have been prescribed to the third unit of this course. The activities that you perform will be assigned one at a time. A LAP will give you directions for each activity. Read the LAP and follow the procedure and directions given.

Principal Author(s): P. Hoggatt

GENERAL INSTRUCTIONS CONT.:

After completing each LAP, you are to take the LAP test, score it, and find out the reason for any missed items before beginning the next assigned LAP.

When you finish the performance activities for the unit, you will be given a unit test as stated in the "Evaluation Procedures" for post testing. After successful completion of the unit test, the next assigned unit for the course is begun.

PERFORMANCE ACTIVITIES:

.01 Vacuum Tube Triodes
.02 Building a Vacuum Tube Amplifier
.03 Detector-Amplifier
.04 Building a Detector-Amplifier
.05 Regenerative Feedback
.06 Building a Regenerative Detector-Amplifier

EVALUATION PROCEDURE:

When pretesting:

1. The student takes the unit multiple-choice pretest.
2. Successful completion is 4 out of 5 items for each LAP part of the pretest.
3. The student then takes a unit performance test if the unit pretest was successfully completed.
4. Satisfactory completion of the performance test is meeting the criteria listed on the performance test.

When post testing:

1. The student takes a multiple-choice unit post test and a unit performance test.
2. Successful unit completion is meeting the listed criteria for the performance test.

FOLLOW-THROUGH:

If you have no questions about this guide, you may begin with the first assigned LAP.

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UNIT PRETEST: REGENERATIVE RECEIVERS

77.03.03.01.

1. In the operation of a vacuum tube, in respect to the plate, the cathode is highly:

   a. cold.
   b. negative.
   c. positive.
   d. grid.

2. Can the grid of a triode vacuum tube completely block the flow of electrons between the cathode and plate?

   a. no
   b. only if the grid acts like a screen grid
   c. only if it is positive potential
   d. yes

3. In a triode tube, the grid that acts like a switch, is properly called a:

   a. cathode grid.
   b. control grid.
   c. suppressor grid.
   d. pentogrid.

4. When a grid of a triode tube is highly negative, it acts like what in the circuit.

   a. short
   b. impedance
   c. open
   d. tubular reactance

5. If the grid on a triode vacuum tube is connected to which of the following, it will act to assist the plate in attracting electrons across the tube.

   a. positive voltage
   b. ground
   c. negative voltage
   d. plate load

77.03.03.02.

6. What is the termination a repairman might use in repairing a tube type receiver pertaining to the supply voltage?

   a. rectifier
   b. battery
   c. power tube
   d. B+

7. In a triode tube, if a 4 volt change on the grid causes a 45v change of the plate current, which characteristic of the tube.

   a. impedance match
   b. power factor
   c. amplification factor
   d. true power

8. Another wording for self-bias in a triode amplifier tube is making the cathode what with respect to the grind.

   a. hotter
   b. conductive
   c. positive
   d. negative

9. What is another term a repairman will use for a power supply pertaining to a receiver?

   a. supplier
   b. AC supply
   c. battery eliminater
   d. power tube

10. What do you call the method of biasing when you place the cathode above the ground with a resistor?

    a. plate bias
    b. mutual bias
    c. self-bias
    d. bias supply resistor

77.03.03.03.

11. When half of your signal has been eliminated by a triode, take for various reasons, the signal has become:

    a. amplified.
    b. predominant.
    c. distorted.
    d. rectified.

12. Even though the signal applied to a vacuum tube amplifier swings plus and minus, the grid remains ________ because of the supply voltage.

    a. positive
    b. open circuit
    c. plus and minus
    d. negative

13. When the grid of a triode tube swings positive, what happens in the circuit?

    a. plate current will burn up the load resistor
    b. grid current flows
    c. plate current flows
    d. power supply load resistor will get extremely hot

14. When you lose grid bias voltage on a triode amplifier tube or when it swings positive a very _______ charge will occur across the plate load resistor.

    a. positive
    b. small
    c. large
    d. uneven

15. What is the principle advantage of using a tube over a diode or a detector in an A.M. radio chassis?

    a. more efficient
    b. amplification
    c. rise wave amplification
    d. no distortion

77.03.03.04.

16. What grid condition is the bias in a conventional triode amplifier designed to prevent?

    a. the grid becoming positive
    b. the grid becoming negative
    c. equal signal input
    d. lowering of the plate power

17. What does a repairman call a tube used in electronics that has many uses?

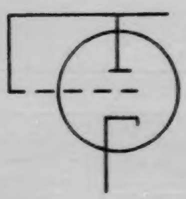
    a. compaction
    b. triode
    c. diode
    d. duo-triode

18. How much negative bias would be desirable in an amplifier designed to handle a signal that swings 2 volts negative and positive 2 volts?

    a. at least positive 4v
    b. at least positive 2v
    c. at least -2v
    d. at least -4v

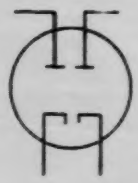
19. What tube does the following symbol represent?

    a. pentode
    b. diode
    c. duo-diode
    d. triode



20. What tube does this symbol stand for?

    a. diode
    b. duo-diode
    c. triode
    d. pentode



77.03.03.05.

21. The coil used in a R.F. filter in a R.F. amplifier can be called by another term, which is:

    a. choke.
    b. transformer.
    c. signal filter.
    d. inductor.

22. What is the technique of increasing the amplification of a circuit by routing it to reamplify signals?

    a. regeneration
    b. resonance
    c. filtering
    d. induction

23. Feedback in a P.A. system is an excellant example of:

    a. oscillation.
    b. regeneration.
    c. induction.
    d. amplification.

24. What kind of electronic device can be used for feedback in an amplifier of a radio?

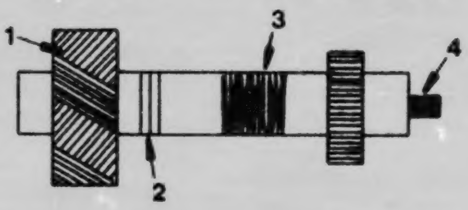
    a. tube
    b. minature transformer
    c. power transformer
    d. capacitor

25. What other device besides a feedback control may be installed in a regenerative feedback system in a R.F. amplifier to improve its operation?

    a. tuneable antenna
    b. tuned capacitor
    c. R.F. filter
    d. filter capacitor

77.03.03.06.

26. In the diagram, which winding is the secondary winding?

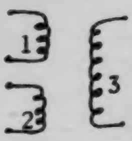


a. 4
b. 2
c. 3
d. 1

27. When using a potentionator in an electronic receiver, what will happen to the resistance as you turn it clockwise.

a. decrease
b. increase
c. remain the same
d. go to zero

28. In the figure , what is the proper name for coil winding labeled 3?



a. load
b. secondary
c. primary
d. tickler

29. In the diagram for item 28, what is the name of coil 1?

a. load
b. **secondary**
c. **shunt**
d. **primary**

30. In the diagram for item 26, which winding is the primary winding?

a. 4
b. 1
c. 2
d. 3

UNIT PRETEST ANSWER KEY: REGENERATIVE RECEIVERS

LAP		
01	1.	B
	2.	D
	3.	B
	4.	C
	5.	A
02	6.	D
	7.	C
	8.	C
	9.	C
	10.	C
03	11.	D
	12.	D
	13.	B
	14.	B
	15.	B
04	16.	A
	17.	A
	18.	C
	19.	D
	20.	B
05	21.	A
	22.	A
	23.	B
	24.	B
	25.	C
06	26.	C
	27.	A
	28.	C
	29.	D
	30.	B

File Code: 77.03.03.01.A2-0

Date Published: 11/12/75

Mountain-Plains Education &
Economic Development
Program, Inc.
Glasgow AFB, Montana 59231

Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Vacuum Tube Triodes

OBJECTIVE:

Identify terms commonly used to describe the function and operations of vacuum tube triodes.

EVALUATION PROCEDURE:

Successfully complete at least 80% of the items on a multiple-choice test about this LAP.

RESOURCES:

Basic Radio, Part 1, Heath Company.

PROCEDURE:

1. Read pages 52-57 in Basic Radio (Part 1).
2. Take the LAP test.

Principal Author(s): P. Schuster

LAP TEST ANSWER KEY: VACUUM TUBE TRIODES

1. A
2. C
3. D
4. B
5. D
6. D
7. A
8. B
9. A
10. D

File Code: 77.03.03.02.A2-0

Date Published: 11/12/75

Mountain-Plains Education &
Economic Development
Program, Inc.
Glasgow AFB, Montana 59231

Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Building a Vacuum Tube Amplifier

OBJECTIVE:

Given parts, equipment and supplies, assemble a vacuum tube amplifier according to the manufacturer's specifications and following the procedures in Basic Radio, Part 1.

EVALUATION PROCEDURE:

Assembly is evaluated at the end of this unit.

Successfully complete at least 80% of the items on a multiple-choice test about this LAP.

RESOURCES:

Basic Radio, Part 1, Heath Company.
Heath Kit EK-2A.

Hand tools.
Soldering iron.
Soldering tools.
2 - 1.5 volt cells.
Volt-ohm meter.

PROCEDURE:

1. Read pages 57-66 in Basic Radio (Part 1).
2. Assemble a vacuum tube amplifier following steps on pages 57-63.
3. Do the experiment described on pages 64 & 65.
4. Answer questions found on page 67.
5. Check answers with the answer key on page 85.
6. Take the LAP test.

Principal Author(s): P. Schuster

LAP TEST ANSWER KEY: BUILDING A VACUUM TUBE AMPLIFIER

1. A
2. A
3. A
4. A
5. C
6. C
7. B
8. A
9. D
10. B

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File Code: 77.03.03.03.A2-0

Date Published: 11/12/75

Learning Activity Package

Student: __________

Date: __________

PERFORMANCE ACTIVITY: Detector-Amplifier

OBJECTIVE:

Identify terms commonly used to describe the functions and operations of a detector-amplifier contained in radio receivers.

EVALUATION PROCEDURE:

Successfully complete at least 80% of the items on a multiple-choice test about this LAP.

RESOURCE:

Basic Radio, Part 1, Heath Company.

PROCEDURE:

1. Read pages 68-69 in Basic Radio (Part 1).
2. Take the LAP test.

Principal Author(s): P. Schuster

LAP TEST ANSWER KEY: DETECTOR-AMPLIFIER

1. B
2. D
3. B
4. A
5. C
6. A
7. D
8. D
9. D
10. B

File Code: 77.03.03.04.A2-0

Date Published: 11/12/75

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Glasgow AFB, Montana 59231

Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Building a Detector-Amplifier

OBJECTIVE:

Given parts, equipment and supplies, assemble a detector-amplifier according to the manufacturer's specifications and following the procedures described in the text, Basic Radio, Part 1.

EVALUATION PROCEDURE:

Assembly is evaluated after completing this unit.

Successfully complete at least 80% of the items on a multiple-choice test about this LAP.

RESOURCES:

Basic Radio, Part 1, Heath Company.
Heath Kit EK-2A.

Hand tools.
Soldering iron.
Soldering tools.
Desoldering iron.

PROCEDURE:

1. Read "How to Build a Detector-Amplifier" beginning on page 71 in Basic Radio (Part 1).
2. Assemble the detector-amplifier following steps on page 71.
3. Answer questions on page 72.
4. Check answers with the answer key on page 86.
5. Take the LAP test.

Principal Author(s): P. Schuster

File Code: 77.03.03.05.A2-0

Date Published: 11/12/75

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Glasgow AFB, Montana 59231

Learning Activity Package

Student: ______________________

Date: ______________________

PERFORMANCE ACTIVITY: Regenerative Feedback

OBJECTIVE:

Identify terms commonly used in the industry to describe the function of regenerative feedback used on radio receivers.

EVALUATION PROCEDURE:

Successfully complete at least 80% of the items on a multiple-choice test about this LAP.

RESOURCE:

Basic Radio, Part 1, Heath Company.

PROCEDURE:

1. Read pages 73-75 in Basic Radio (Part 1).
2. Take the LAP test.

Principal Author(s): P. Schuster

LAP TEST ANSWER KEY: REGENERATIVE FEEDBACK

1. C
2. C
3. A
4. D
5. C
6. D
7. C
8. C
9. D
10. D

File Code: 77.03.03.06.A2-0

Date Published: 11/12/75

Mountain-Plains Education &
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Program, Inc.
Glasgow AFB, Montana 59231

Learning Activity Package

Student: ________________

Date: ________________

PERFORMANCE ACTIVITY: Building a Regenerative Detector-Amplifier

OBJECTIVE:

Given parts, equipment and supplies, assemble a regenerative detector-amplifier according to the manufacturer's specifications and following the procedures described in the text, Basic Radio, Part 1.

EVALUATION PROCEDURE:

Assembly is evaluated after completing this unit.

Successfully complete at least 80% of the items on a multiple-choice test about this LAP.

RESOURCES:

Basic Radio, Part 1, Heath Company.
Heath Kit EK-2A.

Hand tools.
Soldering iron.
Soldering tools.

PROCEDURE:

1. Read "How to Build a Regenerative Detector-Amplifier" beginning on page 76 in Basic Radio (Part 1).
2. Build a regenerative detector-amplifier following steps on pages 76-78.
3. Answer questions on page 83.
4. Check answers with the answer key on page 86.
5. Take the LAP test.

Principal Author(s): P. Schuster

LAP TEST ANSWER KEY: BUILDING A REGENERATIVE DETECTOR AMPLIFIER

1. D
2. C
3. D
4. A
5. B
6. B
7. B
8. B
9. D
10. C

File Code: 77.03.03.07 A1-0

Date Published: 7/12/76

Mountain-Plains Education &
Economic Development
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Glasgow AFB, Montana 59231

Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Tube Checker Operation

OBJECTIVE:

Given a tube assortment, tube checker and data sheet, check and record the tubes mutual and leakage transconductance.

EVALUATION PROCEDURE:

Successfully complete 80% of the questions on a LAP test. Student Performance Data Sheet must have 100% of the line items correct. (attached)

RESOURCES:

Hickok Instruction Manual for Hickok Model 539C tube checker
Hickok 539C tube checker
tube assortment

PROCEDURES:

1. Read "Operating Instructions for Model 539C tube tester" in the above resource.
2. View video tape, "Procedure for Using the Hickok 539C tube checker."
3. Obtain the tube assortment.
4. Check the tubes and fill out the attached Practice Data Sheet.
5. Have the instructor verify your Practice Data Sheet.
6. If satisfactory, take the LAP test.
7. If not satisfactory, proceed as directed by the instructor.
8. After taking the LAP test, obtain the tube assortment and complete the attached Performance Data Sheet.

Principal Author(s): B. Vetter

o.	Tube Number	Minimum Reading	Your Reading	Shorts (Megohms)

No.	Tube Number	Minimum Reading	Your Reading	~~Short~~ Shorts (Megohms)

Student: ______________________ File Code: 77.03.03.00. B2-2

Date: ______________________ Date Published: 7/8/75

Mountain-Plains Education &
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UNIT POST TEST: REGENERATIVE RECEIVERS

77.03.03.01.

1. The resistor in the plate circuit which plate current flows through to eliminate a "short" on the tube is called:
   - a. load resistor.
   - b. bleeder resistor.
   - c. power drop.
   - d. fused resistor.

2. If the grid is connected to which of the following, it will help the plate attract the free electrons in a triode tube.
   - a. negative voltage
   - b. the plate
   - c. plate load resistor
   - d. the cathode

3. Where do the electrons pass when they leave the cathode in a triode vacuum tube?
   - a. grounded through the grid
   - b. through the grid
   - c. cathode to grid and to ground
   - d. cathode to plate and back to grid

4. The grid of a triode tube will actually control the voltage across which of the following in the plate circuit of a circuit.
   - a. power supply
   - b. plate resistance
   - c. load resistor
   - d. plate impedance

5. A plate load resistor in a vacuum triode circuit has a measurable _____ across it.
   - a. heat sink
   - b. grid voltage
   - c. voltage drop
   - d. current drop

77.03.03.02.

6 If the control grid of a triode tube is made slightly negative, the voltage across the plate resistor will:

a. decrease.
b. increase.
c. remain the same.
d. go to zero.

7. What is the purpose of an electrolytic capacitor in a power supply of an electronic receiver?

a. to step up the voltage
b. to filter D.C.
c. to provide capacitive reactance
d. to put a load on the transformer

8. What is another name a repairman will use for a power supply in auto radio repair?

a. AC supply
b. supplier
c. power tube
d. battery eliminator

9. If you apply a small______to the grid of a triode tube, you will get a large signal output on the plate.

a. bias
b. voltage
c. resistor
d. signal

10. Placing a small negative voltage on the control grid is called_____the tube.

a. firing
b. the emission
c. controlling
d. biasing

77.03.03.03.

11. The amount of bias on the control grid of a triode tube should always be_____. the value of the incoming signal.

    a. 1.414
    b. half
    c. twice as much
    d. same as

12. In a radio receiverhow many triode(s) are needed for both detection and amplification in some circuit.

    a. 1
    b. 2
    c. 1-1/2
    d. 3

13. The incoming signal applied to the grid of a triode amplifier could do what to the bias and still cause the grid to become positive.

    a. exceed
    b. be the same as
    c. swing negative
    d. reduce.

14. When a control grid of a triode amplifier swings negative, it _____electrons to the plate.

    a. limits
    b. amplifies
    c. blocks
    d. attracts

15. When a radio signal is applied to a grid of a triode tube, and it swings negative, what potential does this give your grid with respect to ground?

    a. B+
    b. negative
    c. positive
    d. zero voltage

77.03.03.04.

16. How much negative bias would be desireable in an amplifier designed to handle a signal that ranges from -2 volts to +2 volts?

    a. at least +2v
    b. at least -4v
    c. at least +4v
    d. at least -2v

17. In a triode amplifier, the negative half of the signal is amplified satisfactorily and the positive half of the signal:

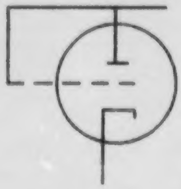
    a. distorts.
    b. cancels out.
    c. amplifies.
    d. doubles.

18. What does a repairman call a tube used in electronic application that has many uses, but is contained in one envelope?

    a. compaction
    b. diode
    c. duo-triode
    d. triode

19. What tube does the following symbol represent?

    a. diode
    b. pentode
    c. triode
    d. duo-diode



20. What grid condition is the bias in a conventional triode amplifier designed to prevent?

    a. grid becoming positive
    b. keep the plate power down
    c. grid becoming negative
    d. keep the signal input the same

77.03.03.05.

21. The objective for regeneration in a detector-amplifier circuit is to increase the amplification of the circuit but not to cause:

    a. oscillation.
    b. motor bosting.
    c. boot-strapping.
    d. resonant.

22. What is the technique of increasing the amplification of a circuit by covering it to reamplify signals.

    a. filtering
    b. resonance
    c. regeneration
    d. induction

23. A steady D.C. will not work in:

    a. a coil.
    b. iron cores.
    c. a transformer.
    d. an inductor.

24. What type of device is installed in a regeneration circuit that would eliminate oscillation and excessive feedback?

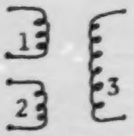
    a. feedback control
    b. variable transformer
    c. variable capacitor
    d. rheostat

25. In a R.F. amplifier, the RFC filter used in conjunction with the feedback control has what job to perform in connection with the radio?

    a. to filter out all audio that might develop
    b. to amplify certain frequencies of R.F.
    c. to pass R.F. signals
    d. block R.F. signals

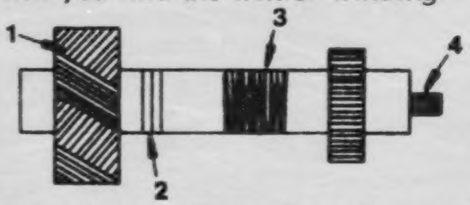
77.03.03.06.

26. In the wiring diagram, what is the proper name of the winding marked 2?



- a. load
- b. tickler
- c. primary
- d. secondary

27. Where, in the diagram, will you find the tickler winding?

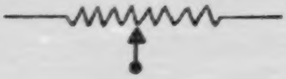


- a. 3
- b. 1
- c. 2
- d. 4

28. In the diagram for item 27, which number is the primary winding labeled by?

- a. 3
- b. 4
- c. 1
- d. 2

29. The following electronic symbol stands for a:



- a. variable resistor.
- b. variable capacitor.
- c. variable transformer.
- d. a fixed 1/4w resistor.

30. What is the value and tolerance of a resistor if it is color coded yellow, purple, brown, gold?

- a. 470 ohm 5%
- b. 47 ohm 10%
- c. 1/2w 470k 5%
- d. 330 ohm 20%

UNIT POST TEST ANSWER KEY: REGENERATIVE RECEIVERS

LAP		
01	1.	A
	2.	B
	3.	B
	4.	C
	5.	C
02	6.	A
	7.	B
	8.	D
	9.	D
	10.	D
03	11.	B
	12.	A
	13.	A
	14.	A
	15.	B
04	16.	D
	17.	B
	18.	A
	19.	C
	20.	A
05	21.	A
	22.	C
	23.	C
	24.	A
	25.	D
06	26.	B
	27.	C
	28.	C
	29.	A
	30.	A

LAP TEST ANSWER KEY: BUILDING A DETECTOR-AMPLIFIER

1. B
2. C
3. D
4. C
5. B

Student: ____________________ File Code: 77.03.03.00.A1-5

Date: ____________________ Date Published: 11-14-74

Mountain-Plains Education &
Economic Development
Program, Inc.
Glasgow AFB, Montana 59231

Family Pay Number: __________ Sex: M F (Circle 1)

UNIT PERFORMANCE TEST: REGENERATIVE RECEIVERS

OBJECTIVE:

Given parts (Heathkit ER-2A), equipment, and supplies, assemble a regenerative detector-amplifier according to the manufacturer's specifications and following the procedures described in the text, Basic Radio, Part 1, page 57-86.

TASK:

The student will be given components and equipment to assemble a regenerative detector-amplifier and do circuit evaluations.

ASSIGNMENT:

CONDITIONS:

The student will be tested in an environment similar to that of a radio-TV repair shop. He will be supplied with the same tools and reference manuals normally available to radio-TV service persons. He may receive no assistance from other students or the instructor.

RESOURCES:

Basic Radio, Part 1, Heath Co., 1961.

Heathkit, Model EK-2A, Heath Co., 1961.

Soldering iron, needle nose pliers, nut driver set, screw drivers, slip joint pliers.

Student: ____________________
File Code: 77.03.03.00.A1-5

Date: ____________________
Date Published: 11-14-74

Mountain-Plains Education &
Economic Development
Program, Inc.
Glasgow AFB, Montana 59231

Family Pay Number: __________ Sex: M F (Circle 1)

PERFORMANCE CHECKLIST:

OVERALL PERFORMANCE: Satisfactory_____ Unsatisfactory_____

	CRITERION	
	Met	Not Met
Objective 1:		
1. Proper solder techniques.		
Criterion: Basic Radio, Part 1, Page VIII.		
2. Proper Placement of components.		
Criterion: Basic Radio, Part 1, Page 79.		
3. Proper wiring installed.		
Criterion: Basic Radio, Part 1, Page 79.		
4. Tubes and lamp light when voltage is applied.		
Criterion: Basic Radio, Part 1, Pages 49 and 79.		
5. Successful completion of the circuit evaluation.		
Criterion: Basic Radio, Part 1, Page 80.		
6. Follows safety procedures.		
Criterion: Basic Radio, Part 1, Page 49.		
7. Temporary type lap joints used when applicable.		
Criterion: Basic Radio, Part 1, Pages 47 and 49.		

(Checklist continued)

	CRITERION Met	 Not Met
8. Task completed in allotted time.		
Criterion: Doesn't exceed 5 hours.		
Student must meet criterion on 6 line items to obtain an over-		
all score of satisfactory.		

Student: ______________________ File Code: 77.03.03.01. A2-2

Date: ______________________ Date Published: 8/7/74

Mountain-Plains Education &
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Glasgow AFB, Montana 59231

LAP TEST: VACUUM TUBE TRIODES

1. Where in a triode vacuum tube are the grid elements placed for effective operations?

   a. between cathode and plate
   b. between the plate and glass envelope
   c. grounded through the cathode
   d. grounded through the plate

2. Where do the electrons pass when they leave the cathode in a triode vacuum tube?

   a. cathode to grid and to ground
   b. cathode to plate and back to grid
   c. through the grid
   d. grounded through the grid

3. When a grid of a triode tube is highly negative, it acts like what in the circuit.

   a. impedance
   b. short
   c. tubular reactance
   d. open

4. The grid of a triode tube will actually control the voltage across which of the following in the plate circuit of a circuit.

   a. plate resistance
   b. load resistor
   c. power supply
   d. plate impedance

5. A high negative grid of a triode tube will actually do what to the electrons.

   a. accelerate them
   b. amplify them
   c. attract them
   d. repel them

6. **When the grid of a triode tube becomes highly negative, what across the plate load disappears.**

   a. reactance
   b. resistance
   c. impedance
   d. voltage

7. If the grid on a triode tube is______, it will actually block the flow of electrons from the cathode to the plate.

   a. highly negative
   b. positive
   c. connected to the plate
   d. connected to the cathode bypass capacitor

8. Can the grid of a triode vacuum tube completely block the flow of electrons between the cathode and plate?

   a. only if the grid acts like a screen grid
   b. no
   c. only if it is positive potential
   d. yes

9. **If the grid on a triode vacuum tube is connected towhich of the following, it will act to assist the plate in attracting electrons across the tube.**

   a. positive voltage
   b. negative voltage
   c. ground
   d. plate load

10. A plate load resistor in a vacuum triode circuit has a measurable ____across it.

   a. heat sink
   b. grid voltage
   c. current drop
   d. voltage drop

Student: ______________ File Code: 77.03.03.02. A2-2

Date: ______________ Date Published: 8/7/74

Mountain-Plains Education &
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Glasgow AFB, Montana 59231

LAP TEST: BUILDING A VACUUM TUBE AMPLIFIER

1. What is the purpose of an electrolytic capacitor in a power supply of an electronic receiver?

   a. to filter D.C.
   b. to put a load on the transformer
   c. to provide capacitive reactance
   d. to step up the voltage

2. If the control grid of a triode tube is made slightly positive, the voltage across the plate resistor will:

   a. increase.
   b. remain the same.
   c. fail to rise.
   d. decrease.

3. What is another term a repairman might use for a power supply used in auto radio repair?

   a. battery eliminator
   b. AC supply
   c. supplier
   d. power tube

4. What is the termination a repairman might use in repairing a tube type receiver pertaining to the supply voltage?

   a. B+
   b. battery
   c. power tube
   d. rectifier

5. In a triode tube, if a 4 volt change on the grid causes a 45v change of the plate current, this is what characteristic of the tube?

   a. impedance match
   b. true power
   c. amplification factor
   d. power factor

6. What do you call the method of biasing when you place the cathode above the ground with a resistor?

   a. plate bias
   b. bias supply resistor
   c. self-bias
   d. mutual bias

7. If you apply a small_____to the grid of a triode tube you will get a large signal output on the plate.

   a. bias
   b. signal
   c. resistor
   d. voltage

8. In a triode tube amplifier, where is the output signal taken from when used on an amplifier?

   a. plate
   b. grid
   c. cathode
   d. bias resistor

9. In a triode tube amplifier, the plate is positive and the cathode is negative, your control grid is also negative. Where do you apply your input signal to in a radio circuit?

   a. plate
   b. cathode
   c. plate load resistor
   d. grid

10. What is another term a repairman will use for a power supply pertaining to a receiver?

   a. power tube
   b. power supply
   c. AC supply
   d. supplier

Student: ______________________ File Code: 77.03.03.03. A2-2

Date: ______________________ Date Published: 8/8/74

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LAP TEST: DETECTOR-AMPLIFIER

1. When half of your signal has been eliminated by a triode take for various reasons, the signal has become:

   a. predominant.
   b. rectified.
   c. distorted.
   d. amplified.

2. Even though the signal applied to a vacuum tube amplifier swings plus and minus, the grid remains in what state because of the supply voltage.

   a. open circuit
   b. positive
   c. plus and minus
   d. negative

3. In a radio receiver, how many triode(s) are needed for both detection and amplification in some circuits.

   a. 3
   b. 1
   c. 2
   d. 1-1/2

4. When a radio signal is applied to a grid of a triode tube, and it swings negative, what potential does this give your grid with respect to ground?

   a. negative
   b. zero voltage
   c. positive
   d. BT

5. If the incoming signal applied to the grid of a troide amplifier swings positive by 1v and your bias voltage is a negative 2-1/2v, how much voltage will you have on your grid?

   a. 1.414 x 2-1/2v
   b. 1/2
   c. 1-1/2
   d. 3-1/2

6. When you apply a signal to the unbiased control grid of a triode in an amplifier circuit, only what part of this signal will appear in the plate circuit.

   a. negative half-cycle
   b. positive half-cycle
   c. only .636
   d. only 1.141

7. The incoming signal applied to the grid of a triode amplifier could _____ the bias and still cause the grid to become positive.

   a. be the same as
   b. swing negative
   c. reduce
   d. exceed

8. When the grid of a triode tube swings positive, what happens in the circuit?

   a. plate current flows
   b. plate current will burn up the load resistor
   c. power supply load resistor will get extremely hot
   d. grid current flows

9. If grid current is flowing in an audio amp circuit using a triode tube, what will your plate wave form be like?

   a. O.K.
   b. no plate wave form
   c. same as grid input
   d. distorted

10. The amount of bias on the control grid of a triode tube should always be what level of the value of the incoming signal.

   a. twice as much
   b. half
   c. same as
   d. 1.414

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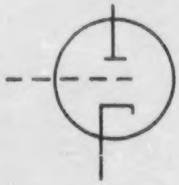
LAP TEST: BUILDING A DETECTOR-AMPLIFIER

1. In a triode amplifier, the negative half of the signal is amplified satisfactorily and the positive half of the signal:

   a. distorts.
   b. cancels out.
   c. amplifies.
   d. doubles.

2. What tube does the following symbol represent?

   a. pentode
   b. duo-diode
   c. triode
   d. diode



3. How much negative bias would be desirable in an amplifier designed to handle a signal that swings 2 volts negative and positive 2 volts?

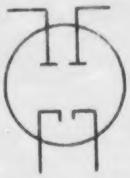
   a. at least positive 2v
   b. at least -4v
   c. at least positive 4v
   d. at least -2v

4. What does a repairman call a tube used in electronic application that has many uses, but is contained in one envelope?

   a. duo-triode
   b. triode
   c. compactron
   d. diode

5. What tube does this symbol stand for?

   a. pentode
   b. duo-diode
   c. diode
   d. triode



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LAP TEST: REGENERATIVE FEEDBACK

1. Referring to figure 9-4 in basic radio part 1, what is the purpose of the .005 MF capacitor in this amplifier network?

   a. to give the variable capacitor additional help
   b. to establish grid bias
   c. D.C. blocking
   d. additional help for the feed-back circuit

2. What is the technique of increasing the amplification of a circuit by covering it to reamplify signals.

   a. induction
   b. resonance
   c. regeneration
   d. filtering

3. What is another term for feedback control used in a R.F. amp circuit in an electronic device?

   a. regeneration control
   b. oscillation control
   c. BFO control
   d. RL control

4. In a R.F. amplifier, the RFC filter used in conjunction with the feedback control has what job to perform in connection with the radio?

   a. to amplify certain frequencies of R.F.
   b. to filter out all audio that might develop
   c. to pass R.F. signals
   d. to block R.F. signals

5. The coil used in R.F. filter in a R.F. amplifier cna be used by another term, in this case:

   a. signal filter.
   b. inductor.
   c. choke.
   d. transformer.

6. The feedback control installed in a regenerative feedback circuit does what main function in this circuit?

   a. changes the inductance of the coil
   b. varies the frequency
   c. changes frequency of the RLC network
   d. controls amount of feedback

7. What do you call the magnetic coupling between coils of wire in a transformer?

   a. self-inductance
   b. variable current
   c. mutual induction
   d. A.C.

8. What type of device is installed in a regeneration circuit that would eliminate oscillation and excessive feedback?

   a. variable transformer
   b. variable capacitor
   c. feedback control
   d. rheostat

9. What is another word for reamplifying signals in a triode amplifier?

   a. reactance
   b. filtering
   c. resonance
   d. feedback

10. A steady D.C. will not work in:

   a. an inductor.
   b. iron cores.
   c. a coil.
   d. a transformer.

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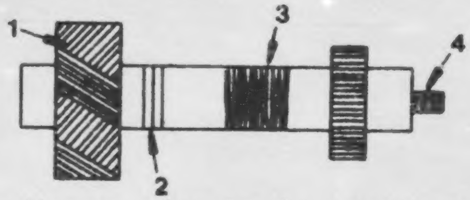
LAP TEST: BUILDING A REGENERATIVE DETECTOR-AMPLIFIER

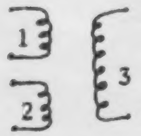
1. In the diagram, which winding is the primary winding?

   a. 3
   b. 4
   c. 2
   d. 1



2. In the wiring diagram, what is the proper name of the winding marked 2?

   a. secondary
   b. load
   c. tickler
   d. primary



3. For best operation of a feedback circuit, the regeneration control should be set:

   a. just above the point of oscillation.
   b. at the high end of the control.
   c. just at oscillation.
   d. just below the point of oscillation.

4. When a R.F. amplifier circuit goes into oscillation in a radio chassis, it will:

   a. transmit a signal.
   b. draw too much current.
   c. go into first regeneration.
   d. ground out the R.F. signal.

5. In the wiring of the coil, diagramed for item 2, what is the proper name of the coil designated by number 1?

   a. load
   b. secondary
   c. primary
   d. shunt

6. What is the value and tolerance of a resistor if it is color coded yellow, purple, brown, gold?

   a. 330 ohms 20%
   b. 470 ohm 5%
   c. 47 ohm 10%
   d. 1/2w 470k 5%

7. Where,in the diagram for item 1, will you find the tickler winding?

   a. 1
   b. 2
   c. 3
   d. 4

8. In the figure for item 2, what is the proper name for coil winding labeled 3?

   a. load
   b. primary
   c. tickler
   d. secondary

9. In the diagram for item 1, which winding is the secondary winding?

   a. 1
   b. 4
   c. 3
   d. 2

10. When using a petentionator in an electronic receiver, what will happen to the resistance as you turn it clockwise.

   a. remain the same
   b. go to zero
   c. decrease
   d. increase

1. In what position on the Hickok tubechecker is the plate volts selector switch placed?

* a. normal
b. low
c. high
d. shorts

2. The first digits of a tube number indicate what:

* a.
b. number of pins
c. short setting
d. plate voltage

3. How many pins does a compaction tube have:

* a. 12
b. 11
c. 7
d. 9

4. In what position on the Hickok tube checker will a heater-cathode short in a tube cause the neon lamp to glow?

* a. 1
b. 2
c. 3
d. 4

5. What value of resistance in a shorted tube will cause a "noise" in television repeater circuits on coaxial lines.

* a. 30 megohms
b. 15 megohms
c. 25 megohms
d. 35 megohms

6. What position on the Hickok tube checker short switch selector will indicate heater-cathode leakage?

* a. a
b. b
c. c
d. d

7. How are the two top cap jacks in the upper center of the control panel marked?

* a. grid and plate
b. grid and cathode
c. grid and normal
d. grid and non-grid

8. How many meters are on the control panel face of the Hickok tubechecker?

* a. 3
b. 4
c. 2
d. 5

9. Where does the #81 fuse lamp provide its protection in the 539C tubechecker?

a. primary of transformer
b. secondary of transformer
c. bias supply transformer
d. power meter object control

10. How many ranges are there on the Hickok tubechecker function switch?

* a. 8
b. 9
c. 7
d. 6

11. What other push switch on the Hickok tubechecker besides P1 and P2 are used to test various types of rectifier elements?

* a. P3
b. P4
c. P5 locked
d. P6

12. What is the purpose of the row of seven selector switches across the center of the control panel on the Hickok tubechecker?

a. conducting proper voltages to the tube's bore pins
b. connecting the meter with the tube
c. to produce the correct voltage
d. to set up the correct filament tops from the transformer

13. If a tube isn't listed on the tubechecker roll chart, where would you possibly look next?

a. obsolete tube manual
b. ask the instructor
c. use the tube substitution book
d. use the cross reference book

14. On the Hickok 539C tubechecker, where generally are the high number tubes located?

* a. latter part of right side
b. forward part of right side
c. latter part of left side
d. forward part of left side

15. How could the plate current of a tube be determined by using the Hickok tubechecker?

   a. using a milliammeter in the test post
   b. calculating current by voltage and resistance
   c. using the roll chart data
   d. using a tube manual data

GENERAL INSTRUCTIONS:

You have been prescribed to the fourth unit of this course. The activities that you perform will be assigned one at a time. A LAP will give you directions for each activity. Read the LAP and follow the procedure and directions given.

After completing each LAP, you are to take the LAP test, score it, and find out the reason for any missed items before beginning the next assigned LAP.

When you finish the performance activities for the unit, you will be given a unit test as stated in the "Evaluation Procedures" for post testing. After successful completion of the unit test, the next assigned unit for the course is begun.

PERFORMANCE ACTIVITIES:

.01 Permanently Soldered Electrical Connections
.02 Transformers
.03 Transformer Coupling
.04 Radio Power Supplies
.05 Building a Radio Power Supply

EVALUATION PROCEDURE:

When pretesting:

1. The student takes the unit multiple-choice pretest.
2. Successful completion is 4 out of 5 items for each LAP part of the pretest.
3. The student then takes a unit performance test if the unit pretest was successfully completed.
4. Satisfactory completion of the performance test is meeting the criteria listed on the performance test.

When post testing:

1. The student takes a multiple-choice unit post test and a unit performance test.
2. Successful unit completion is meeting the listed criteria for the performance test.

FOLLOW-THROUGH:

This guide was intended to give you an overview of the unit. Please begin with the first assigned LAP and follow those specific directions.

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Date: ____________________ Date Published: 8/8/74

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UNIT PRETEST: RADIO POWER SUPPLY SECTION

77.03.04.01.

1. What type of flux should be used in electronic applications?

   a. acid flux
   b. 60/40
   c. rosin flux
   d. 40/60

2. When desoldering a component or making a temporary connection, which type of joint should be used?

   a. hooked joint
   b. u-joint
   c. lap joint
   d. crimp joint

3. How much insulation should be removed from the end of a wire to insure a good connection?

   a. 1/2 inch
   b. 1/4 inch
   c. 1/8 inch
   d. 3/4 inch

4. How hot should the serviceman allow the joint to get while soldering?

   a. just hot enough to allow the solder to flow smoothly
   b. hot enough to make the solder drop off the joint
   c. hot enough to fill the entire hole of the terminal
   d. as hot as he can get it

5. Which side of the soldering iron tip should be held against the joint to be soldered?

   a. flat
   b. butt end
   c. round
   d. square

77.03.04.02.

6. Why is a transformer power supply used in a radio or T.V. chassis?

   a. to keep the voltage at a constant level
   b. for impedance matching
   c. to raise the voltage
   d. to lower the voltage

7. The coil of a transformer that is connected to the source of voltage is called the primary winding. All other windings are called:

   a. secondaries
   b. leaders.
   c. ticklers.
   d. followers.

8. If the primary of a power transformer has 2000 turns with 120 vacaapplied, how many turns are needed in the secondary to have an output of 6 vac?

   a. 166 turns
   b. 60 turns
   c. 100 turns
   d. 600 turns

9. The extent of coupling between two inductors is expressed by the term:

   a. self-inductance.
   b. coefficient of coupling.
   c. counter emf.
   d. varying current.

10. What is another name in electronic applications for "transformer action?"

    a. A.C. transfer
    b. self inductance
    c. mutual inductance
    d. D.C. isolation

77.03.04.03.

11. An air-core transformer used in radio application operates best at:

    a. high voltage.
    b. high frequency.
    c. low frequency.
    d. high current.

12. Radio chassis' power transformer cores are laminated in order to:

    a. reduce resistance.
    b. reduce mutual inductance.
    c. increase displacement currents.
    d. reduce eddy currents.

13. In a step-down transformer in a radio, the current through the secondary winding is:

    a. greater than the current in the primary.
    b. directly proportional to the frequency.
    c. less than the current in the primary.
    d. the same as the current in the primary.

14. A step-down transformer in a radio chassis receives energy at one voltage and delivers it at:

    a. a high voltage.
    b. a lower frequency.
    c. a high frequency.
    d. a lower voltage.

15. The material most commonly used to separate the core lamination of a power transformer in a radio is:

    a. varnish.
    b. lead.
    c. resin.
    d. carbon.

77.03.04.04.

16. Which type of filter has the best voltage regulation under conditions of high load currents?

    a. pi-section
    b. choke input
    c. simple capacitor
    d. resistance-capacitor

17. A simple inductance filter in a radio power supply operates on the ability of an inductor to:

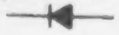
    a. halt the flow of current.
    b. reverse the direction of current flow.
    c. compensate for higher voltage.
    d. resist changes in current.

18. Because a capacitor absorbs energy during the pulse and delivers it to the load of a radio between pulses, the output voltage:

    a. falls to zero.
    b. never falls to zero.
    c. always remains the same.
    d. peaks.

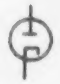
19. The schematic symbol for a semi-conductor rectifying diode in a radio power supply is:

A



a.

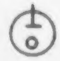
B



b.

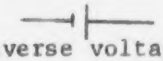
C

c.



d.

D



20. The maximum reverse voltage that can be applied across a rectifier without causing it to break down is called the:

    a. peak inverse voltage.
    b. reverse break-down voltage.
    c. peak reverse voltage.
    d. plate-anode voltage.

77.03.04.05.

21. If there are no markings whatsoever on a diode, its polarity can be determined by using a(n):

    a. ammeter.
    b. ohmmeter.
    c. oscilloscope.
    d. voltmeter.

22. What type of power supply is used for applications that require low volumes of output current?

    a. l-section
    b. capacitance input
    c. simple inductor
    d. bond eliminator

23. In a radio power supply, the pulsating A.C. wave has a peak value ripple voltage of 5v and the maximum output voltage is 100v. What is the minimum output voltage?

    a. 90v
    b. 105v
    c. 75v
    d. 85v

24. The voltage drop across a typical semiconductor diode in a radio power supply varies from:

    a. 0 to 1v.
    b. 10 to 20v.
    c. 25 to 30v.
    d. 1 to 10v.

25. What type of power supply filter is used for applications in radio power supplies that require large volumes of current?

    a. L-section
    b. pi-section
    c. rc filter
    d. capacitance input

UNIT PRETEST ANSWER KEY: RADIO POWER SUPPLY SECTION

LAP		
01	1.	C
	2.	C
	3.	B
	4.	A
	5.	A
02	6.	C
	7.	A
	8.	C
	9.	B
	10.	C
03	11.	B
	12.	D
	13.	A
	14.	D
	15.	A
04	16.	B
	17.	D
	18.	B
	19.	A
	20.	A
05	21.	B
	22.	B
	23.	A
	24.	A
	25.	A

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Learning Activity Package

Student: __________

Date: __________

PERFORMANCE ACTIVITY: Permanently Soldered Electrical Connections

OBJECTIVE:

Identify the procedure for permanently soldering electrical connections.

EVALUATION PROCEDURE:

Successfully complete at least 80% of the items on a multiple-choice test about this LAP.

RESOURCES:

Basic Radio, Part 2, Heath Company.

PROCEDURE:

1. Read pages VIII and IX in Basic Radio (Part 2).
2. Take the LAP test.

Principal Author(s): P. Schuster

LAP TEST ANSWER KEY: PERMANENTLY SOLDERED ELECTRICAL CONNECTIONS

1. B
2. A
3. B
4. C
5. D
6. D
7. C
8. A
9. D
10. D

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Learning Activity Package

Student: ________________

Date: ________________

PERFORMANCE ACTIVITY: Transformers

OBJECTIVE:

Identify terms commonly used in the industry to describe the operation(s) of power transformers used in a radio receiver.

EVALUATION PROCEDURE:

Successfully complete at least 80% of the items on a multiple-choice test about this LAP.

RESOURCES:

Basic Radio, Part 2, Heath Company.

PROCEDURE:

1. Read pages 1-8 in Basic Radio (Part 2).
2. Perform the experiments described on pages 4-7.
3. Answer the questions on page 8 on a separate sheet of paper.
4. Check your answers with the answer key on page 119.
5. Take the LAP test.

Principal Author(s): P. Schuster

LAP TEST ANSWER KEY: TRANSFORMERS

1. B
2. C
3. D
4. C
5. C
6. C
7. D
8. A
9. B
10. A

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Learning Activity Package

Student: ______________________

Date: ______________________

PERFORMANCE ACTIVITY: Transformer Coupling

OBJECTIVES:

Identify the purpose of transformer coupling in a radio power supply. Determine turns ratio of a transformer by measuring voltages.

EVALUATION PROCEDURE:

Successfully complete at least 80% of the items on a multiple-choice test about this LAP.

RESOURCES:

Basic Radio, Part 2, Heath Company.

PROCEDURE:

1. Read pages 1-8 in Basic Radio (Part 2).
2. Take the LAP test.

Principal Author(s): P. Schuster

LAP TEST ANSWER KEY: TRANSFORMER COUPLING

1. D
2. A
3. B
4. B
5. D
6. A
7. C
8. a
9. C
10. D

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Learning Activity Package

Student: ______________________

Date: ______________________

PERFORMANCE ACTIVITY: Radio Power Supplies

OBJECTIVE:

Identify terms commonly used in the industry to describe the operation(s) of a power supply used in a radio receiver.

EVALUATION PROCEDURE:

Successfully complete at least 80% of the items on a multiple-choice test about this LAP.

RESOURCES:

Basic Radio, Part 2, Heath Company.

PROCEDURE:

1. Read pages 9-15 in Basic Radio (Part 2).
2. Take the LAP test.

Principal Author(s): P. Schuster

LAP TEST ANSWER KEY: RADIO POWER SUPPLIES

1. C
2. D
3. B
4. A
5. C
6. A
7. A
8. D
9. C
10. A

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Learning Activity Package

Student: ______________________

Date: ______________________

PERFORMANCE ACTIVITY: Building a Radio Power Supply

OBJECTIVE

Given parts, equipment, and supplies; assemble a radio power supply according to the manufacturer's specifications and following the procedures described in the text, Basic Radio, Part 2.

EVALUATION PROCEDURE:

Assembly is evaluated at the end of this unit.

Successfully complete at least 80% of the items on a multiple-choice test about this LAP.

RESOURCES:

Basic Radio, Part 2, Heath Company.

Heath Kit EK - 2 B.
Soldering iron.
Hand tools.
Soldering aides.

PROCEDURE:

1. Read pages 15 - 19 in Basic Radio (Part 2).
2. Build a radio power supply following steps on pages 15-19.
3. Answer the questions on page 19 using a separate sheet of paper.
4. Check answers with answer key on page 119.
5. Take the LAP test.

Principal Author(s): P. Schuster

77.03.04.05. A2-2

LAP TEST ANSWER KEY: BUILDING A RADIO POWER SUPPLY

1. D
2. A
3. D
4. C
5. D
6. C
7. C
8. D
9. C
10. A

Student: ______________________ **File Code:** 77.03.04.00. B2-2

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UNIT POST TEST: RADIO POWER SUPPLY SECTION

77.03.04.01.

1. When a wire is to be soldered to a terminal in a radio chassis, the soldering iron is applied to:
    - a. both the wire and the terminal.
    - b. the wire only.
    - c. the terminal only.
    - d. the chassis ground.
2. A soldering iron works well only when:
    - a. it is heated to 500 degrees fahrenheit.
    - b. 60/40 solder is used.
    - c. the tip is cleaned and tinned properly.
    - d. it is heated to 200 degrees fahrenheit.
3. Why must the terminals to be soldered in electronic applications be clean?
    - a. so the wires can be crimped more easily
    - b. to provide more line resistance
    - c. to dissipate heat
    - d. to get a good solder connection
4. Which of the following soldering gun sizes should be used to safely solder electronic components?
    - a. 15 - 20w
    - b. 100 - 125w
    - c. 100 - 200w
    - d. 25 - 100w
5. Whenever there is a possibility that bare leads may short-out to other parts or to the chassis itself, these leads should be covered with:
    - a. plastic shields.
    - b. sleeving.
    - c. cloth.
    - d. tape.

77.03.04.02.

6. A transformer designed for low-frequency operation requires a core of:

   a. low permeability.
   b. low reluctance.
   c. high retentivity.
   d. high reluctance.

7. In a step-up transformer of a radio or T.V., the primary current is:

   a. less than the secondary current.
   b. equal to the secondary current.
   c. equal to the coefficient of coupling.
   d. more than the secondary current.

8. If the primary of a radio power transformer has 400 turns with 120 vac applied, what is the voltage output form a 50 turn secondary?

   a. 20v
   b. 12v
   c. 15v
   d. 25v

9. A step-up power transformer in a radio or T.V. chassis has:

   a. a voltage input and a high voltage output.
   b. a frequency input and a high frequency output.
   c. a current input and a high current output.
   d. a power input and a high power output.

10. A.C. transformers in radio or T.V. chassis provide a major service by isolating:

    a. the power supply.
    b. A.C.
    c. D.C.
    d. the chassis itself.

77.03.04.03.

11. Copper losses in a power transformer of a radio may be minimized by using:

    a. laminated cores.
    b. high-resistance windings.
    c. windings of a small diameter.
    d. windings of a large diameter.

12. The power dissipated by winding resistance in a radio's power transformer is called I squared R loss or:

    a. hysteresis loss.
    b. copper loss.
    c. core current.
    d. eddy current loss.

13. If the input power to a transformer of a radio's power supply is 600 w and the output power is 594 w, what is the efficiency?

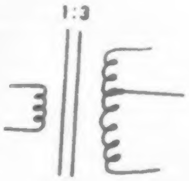
    a. 96%
    b. 95%
    c. 99%
    d. 97%

14. Which type of transformer loss is reduced by using silicon steel as the core material?

    a. flux leakage
    b. copper loss
    c. hysteresis loss
    d. eddy current loss

15. The following schematic symbol is for a:

    a. step-down, iron-core, tapped-secondary transformer.
    b. step-down, air-core, tapped transformer.
    c. step-up, air-core, tapped transformer.
    d. step-up, iron-core, tapped-secondary transformer.



77.03.04.04.

16. The ripple frequency of a full-wave rectifier power supply is:

    a. equal to the A.C. supply frequency.
    b. one-half the A.C. supply frequency.
    c. independent of the A.C. supply frequency.
    d. twice the A.C. supply frequency.

17. Pulsating D.C. smoothing may be best improved in a radio chassis by means of:

    a. pi- or L-section filter.
    b. a full wave rectifier.
    c. multi pi- or L-section filters in series.
    d. a half-wave rectifier.

18. A device which converts A.C. power to D.C. power at various voltages in order to oeprate a piece of electronic equipment is a:

    a. rectifier.
    b. power supply.
    c. battery.
    d. filter.

19. The frequency of the pulsating D.C. from a rectifier output in a radio power supply is:

    a. the rectifier frequency.
    b. the output frequency.
    c. the ripple frequency.
    d. the filter frequency.

20. The smoothing action provided by a capacitor filter in a radio or T.V. power supply depends on the:

    a. amount of excess energy available.
    b. temperature.
    c. load.
    d. storage ability of the capacitor.

77.03.04.05.

21. What is the big disadvantage of using an inductor as a filter in an electronic power supply?

    a. lower voltage output
    b. high voltage output
    c. lower current output
    d. nearly constant current output

22. What is the one thing a repairman has to observe when replacing or installing electrolytic capacitors in a radio power supply?

    a. physical size
    b. resistance
    c, voltage
    d. polarity

23. In any power supply filter, the greatest amount of filtering occurs in the:

    a. second component.
    b. third component.
    c. forth component.
    d. first component.

24. What type of power supply filter is used 6or applications that require large amounts of current?

    a. m-section
    b. pi-section
    c. series L-section
    d. t-section

25. The filtering action in a power supply using an inductor depends on the inductor's:

    a. low resistance.
    b. low inductive reactance.
    c. long discharge time.
    d. ability to prevent abrupt changes in current magnitude.

UNIT POST TEST ANSWER KEY: RADIO POWER SUPPLY SECTION

LAP		
01	1.	A
	2.	C
	3.	D
	4.	D
	5.	B
02	6.	B
	7.	D
	8.	C
	9.	A
	10.	C
03	11.	D
	12.	B
	13.	C
	14.	C
	15.	D
04	16.	D
	17.	A
	18.	B
	19.	C
	20.	D
05	21.	A
	22.	D
	23.	D
	24.	C
	25.	D

Student: ______________________ File Code: 77.03.04.00.A1-5

Date: ______________________ Date Published: 11/25/75

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Family Pay Number: __________ Sex: M F (Circle 1)

UNIT PERFORMANCE TEST: RADIO POWER SUPPLY SECTION

OBJECTIVE:

Given parts (Heathkit EK-2B), equipment, and supplies, assemble a radio power supply according to the manufacturer's specifications and following the procedures described in the text, Basic Radio, Part 2, pages 15-18.

TASK:

The student will be given components, tools and equipment to assemble a radio power supply.

ASSIGNMENT:

CONDITIONS:

The student will be tested in an environment similar to that of a radio-TV repair shop. He will be supplied with the same tools and reference manuals normally available to radio-TV service persons. He may receive no assistance from other students or the instructor.

RESOURCES:

Basic Radio, Part 2, Heath Co., 1961.

Heathkit, Model EK-2B, Heath Co., 1961.

Tools and equipment.

Soldering iron, needle nose pliers, nut driver set, screwdrivers, 6" crescent wrench.

Student: ______________________ File Code: 77.03.04.00.A1-5

Date: ______________________ Date Published: 11-14-74

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Family Pay Number: __________ Sex: M F (Circle 1)

PERFORMANCE CHECKLIST:

OVERALL PERFORMANCE: Satisfactory_____ Unsatisfactory_____

	CRITERION	
	Met	Not Met
Objective 1:		
1. Proper solder techniques.		
Criterion: Basic Radio, Part 2, Page VIII-IX.		
2. Proper placement of components.		
Criterion: Basic Radio, Part 2, Page 18.		
3. Proper wiring installed.		
Criterion: Basic Radio, Part 2, Page 18.		
4. Tubes and lamp light when voltage is applied.		
Criterion: Basic Radio, Part 1, Pages 49 and 79.		
5. Successful completion of the circuit evaluation.		
Criterion: Basic Radio, Part 2, Page 18-19.		
6. Follows safety procedures.		
Criterion: Basic Radio, Part 2, Page 16.		
7. Temporary type lap joints used when applicable.		
Criterion: Basic Radio, Part 1, Pages 47 and 49.		

	CRITERION Met	Not Met
8. Task completed in allotted time.		
Criterion: Doesn't exceed 4 hours.		
Student must meet criterion on 8 line items to obtain an overall score of satisfactory.		

Student: ______________________ File Code: 77.03.04.01. A2-2

Date: ______________________ Date Published: 8/8/74

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LAP TEST: PERMANENTLY SOLDERED ELECTRICAL CONNECTIONS

1. A soldering iron works well only when:

   a. it is heated to 500 degrees fahrenheit.
   b. the tip is cleaned and tinned properly.
   c. it is heated to 200 degrees fahrenheit.
   d. 60/40 solder is used.

2. Whenever there is a possibility that bare leads may short-out to other parts or to the chassis itself, these leads should be covered with:

   a. sleeving.
   b. tape.
   c. cloth.
   d. plastic shields.

3. Which of the following soldering gun sizes should be used to safely solder electronic components?

   a. 100 - 200 w
   b. 25 - 100 w
   c. 15 - 20 w
   d. 100 - 125 w

4. How hot should the serviceman allow the joint to get while soldering?

   a. as hot as he can get it
   b. hot enough to fill the entire hole of the terminal
   c. just hot enough to allow the solder to flow smoothly
   d. hot enough to make the solder drop off the joint

5. What type of flux should be used in electronic applications?

   a. 40/60
   b. acid flux
   c. 60/40
   d. rosin flux

6. Which of the following most adequately describe a cold solder connection?

   a. silvery and smooth
   b. shiny and smooth
   c. silvery
   d. dull and grainy

7. When soldering, what keeps the solder where the serviceman wants it?

   a. heat sink
   b. pliers
   c. gravity
   d. soldering iron

8. Which side of the soldering iron tip should be held against the joint to be soldered?

   a. flat
   b. square
   c. round
   d. butt end

9. When a wire is to be soldered to a terminal in a radio chassis, the soldering iron is applied to:

   a. the wire only.
   b. the terminal only.
   c. the chassis ground.
   d. both the wire and the terminal

10. Why should the lead of a wire be held with a plier while it is being stripped of insulation?

   a. to keep it clean
   b. to make soldering easier
   c. to keep it from fraying
   d. to keep from breaking it.

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Date: ______________________ Date Published: 8/8/74

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LAP TEST: TRANSFORMERS

1. If the primary of a power transformer has 2000 turns with 120 vac applied. How many turns are needed in the secondary to have an output of 6 vac?

   a. 60 turns
   b. 100 turns
   c. 166 turns
   d. 600 turns

2. Why is a transformer power supply used in a radio or T.V. chassis?

   a. for impedance matching
   b. to keep the voltage at a constant level
   c. to raise the voltage
   d. to lower the voltage

3. A transformer designed for low-frequency operation requires a core of:

   a. high retentivity.
   b. low permeability.
   c. high reluctance.
   d. low reluctance.

4. In air-core coils, the coil is wound around a:

   a. core
   b. winding.
   c. coil form.
   d. powdered iron core.

5. The extent of coupling between two inductors is expressed by the terms:

   a. counter emf.
   b. self-inductance.
   c. coefficient of coupling.
   d. varying current.

6. Which of the following statements is always true when using a transformer in electronic applications?

   a. all transformers have two windings
   b. the magnitude of coupling between the windings cannot be varied
   c. works on A.C. only
   d. will block D.C. through its windings

7. An iron core is used in power transformers of a radio or T.V. for:

   a. dispersing the field about the windings.
   b. increasing the eddy currents.
   c. releasing the high-frequency currents.
   d. concentrating the field about the winding.

8. A step-up power transformer in a radio or T.V. chassis has:

   a. a voltage input and a high voltage output.
   b. a power input and a high power output.
   c. a current input and a high current output.
   d. a frequency input and a high frequency output.

9. If a 3:1 ratio step-down transformer has 3a of current in the primary, what is the current in the secondary?

   a. 6a
   b. 9a
   c. 1a
   d. 3a

10. If a 5:1 ratio step-down transformer has 250 v on the primary, what is the voltage being transferred to the rest of the radio?

   a. 50v
   b. 25v
   c. 250v
   d. 1250v

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Date: ______________________ Date Published: 8/8/74

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LAP TEST: TRANSFORMER COUPLING

1. Copper losses in a power transformer of a radio may be minimized by using:

   a. windings of a small diameter.
   b. laminated cores.
   c. high-resistance windings.
   d. windings of a large diameter.

2. What is the current called which flows in the primary winding of a power transformer with no load applied?

   a. exciting current
   b. eddy current
   c. secondary current
   d. leakage current

3. The power dissipated by winding resistance in a radio's power transformer is called I squared R loss or:

   a. hysteresis loss.
   b. copper loss.
   c. eddy current loss.
   d. core current.

4. The current-handling capacity of a power transformer in a radio is determined by:

   a. the thickness of the insulation.
   b. the physical size of the windings.
   c. the amount of voltage applied.
   d. the shape of the core.

5. Which type of transformer loss is reduced by using silicon steel as the core material?

   a. eddy current loss
   b. flux leakage
   c. copper loss
   d. hysteresis loss

6. The material most commonly used to separate the core lamination of a power transformer in a radio is:

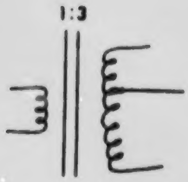
   a. varnish.
   b. resin.
   c. carbon.
   d. lead.

7. Radio chassis' power transformer cores are laminated in order to:

   a. increase displacement currents.
   b. reduce mutual inductance.
   c. reduce eddy currents.
   d. reduce resistance.

8. The following schematic symbol is for a:

   a. step-up, iron-core, tapped-secondary transformer.
   b. step-down, iron-core, tapped-secondary transformer.
   c. step-down, air-core, tapped transformer.
   d. step-up, air-core, tapped transformer.



9. An air-core transformer used in radio application operates best at:

   a. low frequency.
   b. high voltage.
   c. high frequency.
   d. high current.

10. The energy used to realign the magnetic structure of a transformer core twice each cycle is dissipated as heat. This loss is called:

   a. eddy current loss.
   b. flux leakage.
   c. copper loss.
   d. hysteresis loss.

Student: ______________________ File Code: 77.03.04.04. A2-2

Date: ______________________ Date Published: 8/12/74

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LAP TEST: RADIO POWER SUPPLIES

1. A simple inductance filter in a radio power supply operates on the ability of an inductor to:

   a. halt the flow of current.
   b. compensate for higher voltage.
   c. resist changes in current.
   d. reverse the direction of current flow.

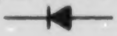
2. What would be the percent of voltage regulation in a perfect radio power supply?

   a. 5%
   b. 100%
   c. 4%
   d. 0%

3. Because a capacitor **absorbs** energy during the pulse, and delivers it to the load of a radio **between pulses**, the output voltage:

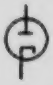
   a. falls to zero.
   b. never falls to zero.
   c. peaks.
   d. always remains the same.

4. The **schematic symbol** for a semi-conductor rectifying diode in a radio power supply is: **A**



   a.

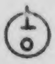
B



   b.

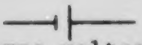
   c.

C



   d.

D



5. The **maximum reverse voltage** that can be applied across a rectifier without causing it to break down is called the:

   a. peak reverse voltage.
   b. plate-anode voltage.
   c. peak inverse voltage.
   d. reverse break-down voltage.

6. A device which converts A.C. power to D.C. power at various voltages in order to operate a piece of electronic equipment is a:

   a. power supply.
   b. rectifier.
   c. filter.
   d. battery.

7. A power supply in a radio whose voltage drops off appreciably under load conditions is said to have:

   a. poor voltage regulation.
   b. a weak current.
   c. good voltage regulation.
   d. an inadequate filter.

8. A diode placed in a circuit so that it permits current to flow through it is said to be:

   a. blocking biased.
   b. passing biased.
   c. reverse biased.
   d. forward biased.

9. When a rectifier is reverse biased in a radio or T.V. power supply, its resistance is:

   a. infinite.
   b. low.
   c. high.
   d. minimum.

10. The ripple frequency of a full-wave rectifier power supply is:

   a. twice the A.C. supply frequency.
   b. equal to the A.C. supply frequency.
   c. independent of the A.C. supply frequency.
   d. one-half the A.C. supply frequency.

Student: ____________________ File Code: 77.03.04.05. A2-2

Date: ____________________ Date Published: 5/13/75

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LAP TEST: BUILDING A RADIO POWER SUPPLY

1. If there are no markings whatsoever on a diode, its polarity can be determined by using a(n):

   a. ammeter.
   b. voltmeter.
   c. oscilloscope.
   d. ohmmeter.

2. What type of power supply filter is used for loads requiring a uniform flow of current?

   a. PI-section
   b. RC filter
   c. capacitance input
   d. L-section

3. When polarity markings are indicated on the body of a semi-conductor rectifier, how is the rectifier placed in an active circuit?

   a. load in parallel
   b. load in series
   c. source in parallel
   d. source in series

4. What is the big disadvantage of using an inductor as a filter in an electronic power supply?

   a. high voltage output
   b. nearly constant current output
   c. lower voltage output
   d. lower current output

5. In any power supply filter, the greatest amount of filtering occurs in the:

   a. third component.
   b. second component.
   c. forth component.
   d. first component.

6. The filtering action in a power supply using an inductor depends on the inductor's:

   a. long discharge time.
   b. low inductive reactance.
   c. ability to prevent abrupt changes in current magnitude.
   d. low resistance.

7. What type of power supply is used for applications that require low volumes of output current?

   a. bond eliminator
   b. L-section
   c. capacitance input
   d. simple inductor

8. In a radio power supply, the pulsating D.C. wave has a peak value ripple voltage of 5v and the maximum output voltage is 100v. What is the minimum output voltage?

   a. 85v
   b. 105v
   c. 75v
   d. 90v

9. What is the one thing a repairman has to observe when replacing or installing electrolytic capacitors in a radio power supply?

   a. physical size
   b. resistance
   c. polarity
   d. voltage

10. What type of power supply filter is used for applications in radio power supplies that require large volumes of current?

    a. L-section
    b. capacitance input
    c. PI-section
    d. RC filter

File Code: 77.03.05.00.A2-1

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Learning Experience Guide

UNIT: RADIO AUDIO SECTION

RATIONALE:

One of the functions of a radio is to convert electrical impulses into audio signals. The audio section has three primary functions. One function is to detect electrical impulses. A second is to amplify those impulses. The third is to convert the electrical impulses to mechanical energy. To understand how audio circuits function is essential for troubleshooting radio audio sections.

PREREQUISITES:

Unit: 77.03.04 - The Radio Power Supply.

OBJECTIVES:

Given a basic radio text/workbook, necessary tools and equipment, identify the operational characteristics of the audio section and a detector circuit.

Test an audio amplifier.

Build a detector circuit.

RESOURCES:

Printed Materials

Basic Radio, Part 2. Heath Company, Benton Harbor, Michigan, 1960.

Equipment

Basic Radio Kit, Heathkit Model EK-2, Heathkit Company, Benton Harbor, Michigan.

Soldering iron.

Service Master Kit 99 SM or equivalent Xcelite 99 XM Kit, Jenson Tools and Alloys, 4117 North 44th Street, Phoenix, Arizona.

Principal Author(s): P. Hoggatt

RESOURCES: (continued)

Volt-Ohm meter.

Soldering tools.

GENERAL INSTRUCTIONS:

This unit consists of six Learning Activity Packages (LAPs). Each LAP will provide specific information for completion of a learning activity.

The general procedure for this unit is as follows:

(1) Read the first assigned Learning Activity Package (LAP).
(2) Begin and complete the first assigned LAP.
(3) Take and score the LAP test.
(4) Turn in the LAP test answer sheet.
(5) Determine the reason for any missed items on the LAP test.
(6) Proceed to and complete the next assigned LAP in the unit.
(7) Complete all required LAPs for the unit by following steps 3 through 6.
(8) In this Unit, there are some LAPs that have tests combined with other LAP tests. These combined tests are taken after completing the last LAP covered by the test.
(9) Take the unit tests as described in the Unit LEG "Evaluation Procedures".
(10) Proceed to the next assigned unit.

PERFORMANCE ACTIVITIES:

.01 Vacuum Tube Amplifiers
.02 Building Audio Amplifiers
.03 Audio Amplifier Functions
.04 Testing the Audio Amplifier
.05 Detector Circuit Functions
.06 Building a Detector Circuit

EVALUATION PROCEDURE:

When pretesting:

1. The student takes the unit multiple-choice pretest.
2. Successful completion is 4 out of 5 items for each LAP part of the pretest.
3. The student then takes a unit performance test if the unit pretest was successfully completed.
4. Satisfactory completion of the performance test is meeting the criteria listed on the performance test.

EVALUATION PROCEDURE: (continued)

When post testing:

1. The student takes a multiple-choice unit post test and a unit performance test.
2. Successful unit completion is meeting the listed criteria for the performance test.

FOLLOW-THROUGH:

If you have any questions at this time, consult with your instructor. You are ready to begin the first assigned Learning Activity Package (LAP) listed on your Student Progress Record (SPR).

Student: ______________________ File Code: 77.03.05.00. A2-2

Date: ______________________ Date Published: 7/29/75

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UNIT PRETEST: RADIO AUDIO SECTION

77.03.05.01.

1. What is the main disadvantage of using a tetrode tube in a radio for an audio amplifier?

   a. capacitance is too low
   b. secondary emission
   c. too much current to drop
   d. positive grid

2. The capacity that exists in a triode vacuum tube between the plate and control grid is called the:

   a. interelectrode capacity.
   b. capacitive resistance.
   c. workable capacity.
   d. stored capacity.

3. How many elements are there in a pentode vacuum tube?

   a. 3
   b. 4
   c. 5
   d. 2

4. What is the name of the element found in a tetrode tube, but not in a triode vacuum tube?

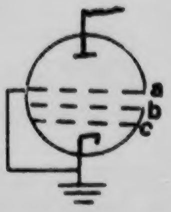
   a. cathode
   b. control grid
   c. screen grid
   d. filament

5. What is the primary function for the extra grid in a tetrode tube?

   a. acts as a standby-input grid
   b. to reduce interelectrode capacitance
   c. to make the tube more linear in amplification
   d. to improve distortion

77.03.05.02.

6. What is the element marked "B" in the following diagram?



a. suppressor grid
b. control grid
c. screen grid
d. cathode

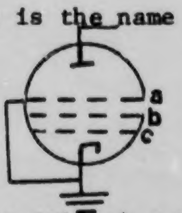
7. Filament voltage of a radio or a television is usually:

a. AC.
b. DC.
c. 6 v.
d. 12v.

8. When a small signal at the grid of a vacuum tube causes a large amount of current to flow through the tube, this is called:

a. secondary emission.
b. amplification.
c. acceleration.
d. demodulation.

9. In the following diagram, what is the name of the element marked "A"?



a. screen grid
b. suppressor grid
c. plate
d. control grid

10. What device is used to hold the coil of a radio speaker in the center of the opening in the magnetic structure to prevent it from rubbing on the pot?

a. magnet
b. basket
c. spider
d. dust cover

77.03.05.03.

11. What is the main purpose of coupling capacitors when used in radio circuits?

    a. to block D.C.
    b. to pass D.C.
    c. to block A.C.
    d. grounding the control grid

12. How effectively an audio amplifier reproduces sound depends mostly on:

    a. its linearity.
    b. the frequency response.
    c. its power factor.
    d. its modulation ability.

77.03.05.04.

13. What component is placed in parallel with the bias resistor of an audio amplifier for stabilization of the output?

    a. by-pass capacitor
    b. resistor
    c. filter capacitor
    d. coupling capacitor

14. What component is connected to the screen grid to help ground A.C. that appears on it?

    a. coupling condensor
    b. grounding resistor
    c. by-pass capacitor
    d. bleeder

15. What is the purpose of the cathode resistor in an audio amplifier tube of a radio?

    a. grounding the suppressor grid
    b. amplification factor
    c. load resistor
    d. bias

77.03.05.05.

16. The three basic things a radio must do to signal are detect, amplify and:

    a. reject.
    b. tune.
    c. de-emphasize.
    d. modulate.

17. Which end of a diode is marked?

    a. the cathode end
    b. the anode end
    c. the high resistance end
    d. the low resistance end

18. Why can a diode tube be used as a signal rectifier?

    a. it amplifies
    b. it's a one-way current device
    c. it uses a grid
    d. it has a high resistance path

77.03.05.06.

19. Detection might be best described as:

    a. inserting audio signals onto an R.F. carrier.
    b. removing the audio from a signal so only the R.F. is amplified.
    c. amplifying audio signals.
    d. separating the audio signals from the radio-frequency signals.

20. What is another term that can be used for a diode?

    a. low resistance device
    b. filter
    c. one-way current device
    d. high resistance device

UNIT PRETEST ANSWER KEY: RADIO AUDIO SECTION

LAP		
01	1.	B
	2.	A
	3.	C
	4.	C
	5.	B
02	6.	C
	7.	A
	8.	B
	9.	B
	10.	C
03	11.	A
	12.	B
04	13.	A
	14.	C
	15.	D
05	16.	B
	17.	A
	18.	B
06	19.	D
	20.	C

File Code: 77.03.05.01.A2-0

Date Published: 11-17-75

Mountain-Plains Education &
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Program, Inc.
Glasgow AFB, Montana 59231

Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Vacuum Tube Amplifiers

OBJECTIVE:

Identify terms commonly used in the industry to describe the operation(s) of vacuum tube amplifiers used in a radio receiver.

EVALUATION PROCEDURE:

Successfully complete at least 80% of the items on a multiple-choice test about this LAP.

RESOURCES:

Basic Radio, Part 2, Heath Company.

PROCEDURE:

1. Read pages 20-24 in Basic Radio (Part 2).
2. Take the LAP test.

Principal Author(s): P. Schuster

LAP TEST ANSWER KEY: VACUUM TUBE AMPLIFIERS

1. A
2. C
3. B
4. C
5. A
6. B
7. D
8. A
9. A
10. A

File Code: 77.03.05.02.A 2-0

Date Published: 11-17-75

Mountain-Plains Education &
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Glasgow AFB, Montana 59231

Learning Activity Package

Student: ________________

Date: ________________

PERFORMANCE ACTIVITY: Building Audio Amplifiers

OBJECTIVE:

Given parts, equipment, and supplies; assemble an audio amplifier according to the manufacturer's specifications and following the procedures described in the text, Basic Radio, Part 2.

EVALUATION PROCEDURE:

Assembly is evaluated at the end of this unit.

Successfully complete at least 80% of the items on a multiple-choice test about this LAP.

RESOURCES:

Basic Radio, Part 2, Heath Company.

Heath Kit EK - 2B.
Hand tools
Soldering iron.
Soldering tools.
Volt-ohm meter.

PROCEDURE:

1. Read pages 26-36 in Basic Radio (Part 2).
2. Build an audio amplifier following procedures on pages 25-31
3. Do experiments described on pages 33-36.
4. Answer questions on page 36.
5. Check answer with answer key on page 119.
6. Take the LAP test.

Principal Author(s): P. Schuster

LAP TEST ANSWER KEY: BUILDING AUDIO AMPLIFIERS

1. B
2. C
3. C
4. A
5. C
6. a
7. D
8. C
9. D
10. D

File Code: 77.03.05.03.A2-0

Date Published: 11-17-75

Mountain-Plains Education &
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Glasgow AFB, Montana 59231

Learning Activity Package

Student: ______________________

Date: ______________________

PERFORMANCE ACTIVITY: Audio Amplifier Functions

OBJECTIVE:

Identify terms commonly used in the industry to describe the operation(s) of audio amplifiers used in a radio receiver.

EVALUATION PROCEDURE:

Successful completion of this LAP is determined by correctly answering 8 out of 10 items on a multiple-choice test that is combined with "Testing the Audio Amplifier" LAP test and is taken after completing that LAP.

RESOURCES:

Basic Radio, Part 2, Heath Company.

PROCEDURE:

1. Read pages 37-41 in Basic Radio (Part 2).
2. Proceed to the next LAP.

Principal Author(s): P. Schuster

File Code: 77.03.05.04.A2-0

Date Published: 11-17-75

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Learning Activity Package

Student: ____________

Date: ____________

PERFORMANCE ACTIVITY: Testing the Audio Amplifier

OBJECTIVE:

Given parts, equipment, and supplies; assemble, test and record amplification factor of an audio amplifier according to the manufacturer's specifications and following the procedures described in the text, Basic Radio, Part 2.

EVALUATION PROCEDURE:

Amplifier testing is evaluated on the unit performance test.

Successfully complete at least 80% of the items on a multiple-choice test.

RESOURCES:

Basic Radio, Part 2, Heath Company.

Heath Kit EK - 2B.
Hand tools.
Soldering iron.
Soldering tools.
Volt-ohm meter.

PROCEDURE:

1. Read pages 41-46 in Basic Radio (Part 2).
2. Perform experiments 1 and 2 using steps given on pages 42-44.
3. Answer questions on page 46.
4. Check answers with key on page 119.
5. Take the LAP test.

Principal Author(s): P. Schuster

77.03.05.03. A2-2
77.03.05.04. A2-2

LAP TEST ANSWER KEY: AUDIO AMPLIFIER FUNCTIONS/TESTING THE AUDIO AMPLIFIER

LAP		
03	1.	C
	2.	A
	3.	D
	4.	A
	5.	C
04	6,	B
	7.	A
	8.	C
	9.	C
	10.	B

File Code: 77.03.05.05.A2-0

Date Published: 11-17-75

Mountain-Plains Education &
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Glasgow AFB, Montana 59231

Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Detector Circuit Functions

OBJECTIVE:

Identify terms commonly used in the industry to describe the operation(s) of a detector circuit used in a radio receiver.

EVALUATION PROCEDURE:

Successfully complete at least 80% of the items on a multiple-choice test about this LAP. This LAP test is combined with the LAP "Building a Detector Circuit" test and is taken after completing that LAP.

RESOURCES:

Basic Radio, Part 2, Heath Company.

PROCEDURE:

1. Read pages 47-50 in Basic Radio (Part 2).
2. Proceed to the next LAP.

Principal Author(s): P. Schuster

File Code: 77.03.05.06.A2-0

Date Published: 11-17-75

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Glasgow AFB, Montana 59231

Learning Activity Package

Student: ____________

Date: ____________

PERFORMANCE ACTIVITY: Building a Detector Circuit

OBJECTIVE:

Given parts, equipment, and supplies; assemble a detector circuit according to the manufacturer's specifications and following the procedures described in the text Basic Radio, Part 2.

EVALUATION PROCEDURE:

Assembly is evaluated at the end of this unit.

Successfully complete at least 80% of the items on a multiple-choice test about this LAP.

RESOURCES:

Basic Radio, Part 2.

Heath Kit EK - 2B.
Hand tools.
Soldering iron.
Soldering tools.

PROCEDURE:

1. Read pages 50-54 in Basic Radio (Part 2).
2. Build a detector circuit following the steps on pages 50-52.
3. Complete experiment 1 on page 52.
4. Answer questions on page 54.
5. Check answers with key on page 120.
6. Take the LAP test.

Principal Author(s): P. Schuster

77.03.05.05. A2-2
77.03.05.06. A2-2

LAP TEST ANSWER KEY: DETECTOR CIRCUIT FUNCTIONS/BUILDING A DETECTOR CIRCUIT

LAP		
05	1.	B
	2.	C
	3.	B
	4.	B
	5.	A
06	6.	A
	7.	A
	8.	C
	9.	D
	10.	A

Student: ______________________ File Code: 77.03.05.00. B2-2

Date: ______________________ Date Published: 8/12/74

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UNIT POST TEST: RADIO AUDIO SECTION

77.03.05.01.

1. In respect to the plate, what is the potential on the screen grid in a tetrode vacuum tube?

   a. same as control grid
   b. same as cathode
   c. positive
   d. negative

2. What is the potential on the suppressor grid of a pentode tube?

   a. positive
   b. ground
   c. same as screen grid
   d. negative

3. What is the name of the element that is found in a pentode tube, but not in a tetrode tube?

   a. control grid
   b. capacitive grid
   c. screen grid
   d. suppressor grid

4. What are the two main functions a power supply must do in order for an electronic circuit to opprate?

   a. provide grid and cathode voltage
   b. provide filament and plate voltage
   c. provide plate and cathode voltage
   d. provide grid and plate voltage.

5. What is the purpose of the resistor in series with the cathode on a triode tube?

   a. a power source
   b. to drop current
   c. amplifying
   d. biasing

77.03.05.02.

6. The first number or digit of a tube number refers to:

   a. power in.
   b. amplification factor.
   c. filament voltage.
   d. power out.

7. Which of the following tubes has the highest amplification factor?

   a. triode
   b. tetrode
   c. diode
   d. pentode

8. In a tetrode or pentode tube, what type of voltage must be applied to the screen grid in order to make it operate?

   a. low D.C.
   b. high D.C.
   c. high A.C.
   d. low A.C.

9. What is the major disadvantage of using a tetrode vacuum tube as an amplifier in a radio?

   a. non-linear operation
   b. inefficiency
   c. distortion
   d. secondary emission

10. What type of current device is a vacuum tube when used in an audio amplifier of a radio?

   a. A.C.
   b. negative
   c. D.C.
   d. low

77.03.05.03.

11. How efficiently an audio amplifier reproduces sound depends mostly on:

    a. its modulation ability.
    b. its power factor.
    c. its linearity.
    d. the frequency response.

12. What is the audio hearing range of the human ear?

    a. 60 HZ to 100 HZ
    b. 60 HZ to 15,750 HZ
    c. 15,000 HZ to 15,750 HZ
    d. 20 HZ to 15,000 HZ

77.03.05.04.

13. Any audible humming or buzzing heard in a radio audio amplifier is a basic form of:

    a. distortion.
    b. response.
    c. noise.
    d. modulation.

14. As a rule, what is the impedance of most speakers used in radios or T.V.'s?

    a. depends entirely on the audio output transformer
    b. 8 ohms
    c. 4 ohms
    d. 16 ohms

15. What component is placed in parallel with the bias resistor of an audio amplifier for stabilization of the output?

    a. by-pass capacitor
    b. coupling capacitor
    c. filter capacitor
    d. resistor

77.03.05.05.

16. If a diode is used as a detector, most likely it is a:

    a. NPN.
    b. silicon type.
    c. PNP.
    d. germanium type.

17. The three basic things a radio must do to a signal are; detect, amplify, and:

    a. tune.
    b. reject.
    c. modulate.
    d. de-emphasize.

77.03.05.06.

18. Detection in a superheterodyne radio occurs:

    a. in the antenna circuit.
    b. before the signal reaches the audio AMP.
    c. after the signal has reached the audio AMP.
    d. before the signal reaches the I.F. AMP.

19. In a radio receiver, how many triodes are needed for both detection and amplification?

    a. 3
    b. 1
    c. 2
    d. 4

20. The function of the detector circuit in a radio is rectifying and:

    a. inverting the modulated broadcast signal that is applied to it.
    b. filtering the modulated broadcast signal that is applied to it.
    c. de-modulating the modulated broadcast signal that is applied to it.
    d. modulating the unmodulated broadcast signal that is applied to it.

UNIT POST TEST ANSWER KEY: RADIO AUDIO SECTION

LAP		
01	1.	C
	2.	B
	3.	D
	4.	B
	5.	D
02	6.	C
	7.	D
	8.	B
	9.	D
	10.	C
03	11.	D
	12.	D
04	13.	A
	14.	B
	15.	A
05	16.	D
	17.	A
06	18.	B
	19.	B
	20.	B

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Glasgow AFB, Montana 59231

Student: ____________________ File Code: 77.03.05.00.A1-5

Date: ____________________ Date Published: 11/25/75

Family Pay Number: ____________ Sex: M F (Circle 1)

UNIT PERFORMANCE TEST: RADIO AUDIO SECTION

OBJECTIVE:

Given parts (Heath Kit EK-2B), equipment, and supplies, assemble a detector circuit in a superheterodyne set according to the manufacturer's specifications and following the procedures described in the text, Basic Radio, Part 2, pages 50-53.

TASK:

The student will be given components, tools and equipment to assemble a radio-audio detector circuit.

ASSIGNMENT:

CONDITIONS:

The student will be tested in an environment similar to that of a radio-TV shop. He will be supplied with the same tools and reference manuals normally available to radio-TV service persons. He may receive no assistance from other students or the instructor.

RESOURCES:

Basic Radio, Part 2, Heath Co., 1961

Heathkit, Model EK-2B, Heath Co., 1961

Soldering iron, needle-nose pliers, nut driver set, screwdrivers, slip joint pliers.

Student: ____________________ File Code: 77.03.05.00.A1-5

Date: ____________________ Date Published: 11-14-74

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Glasgow AFB, Montana 59231

Family Pay Number: __________ Sex: M F (Circle 1)

PERFORMANCE CHECKLIST:

OVERALL PERFORMANCE: Satisfactory_____ Unsatisfactory_____

	CRITERION	
	Met	Not Met
Objective 1:		
1. Proper solder techniques.		
Criterion: Basic Radio, Part 1, Page VIII.		
Basic Radio, Part 11, Page VIII.		
2. Temporary type of lap joint used when applicable.		
Criterion: Basic Radio, Part I, Page 47		
3. Proper placement of components.		
Criterion: Basic Radio, Part 11, Page 53.		
4. Tubes and lamp light when voltage is applied.		
Criterion: Basic Radio, Part 1, page 49. Basic Radio,		
Part 11, Page 16.		
5. Successful completion of experiments.		
Criterion: Basic Radio, Part 11, Page 52.		
6. Follow safety procedures.		
Criterion: Basic Radio, Part 11, Page 16.		

(Checklist continued)

	CRITERION	
	Met	Not Met
7. Proper wiring installed.		
Criterion: Basic Radio, Part 11, Page 53.		
8. Task completed in allotted time.		
Criterion: Doesn't exceed 5 hours.		
Student must meet criterion on 6 line items to obtain an over-		
all score of satisfactory.		

Student: ____________________ **File Code:** 77.03.05.01. A2-2

Date: ____________________ **Date Published:** 8/12/74

Mountain-Plains Education &
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Glasgow AFB, Montana 59231

LAP TEST: VACUUM TUBE AMPLIFIERS

1. What is the potential on the suppressor grid of a pentode tube?

   a. ground
   b. positive
   c. same as screen grid
   d. negative

2. What is the most widely-used tube in present day electronic applications?

   a. diode
   b. tetrode
   c. pentode
   d. triode

3. What is the primary function for the extra grid in a tetrode tube?

   a. acts as a standby-input grid
   b. to reduce interelectrode capacitance
   c. to make the tube more linear in amplification
   d. to improve distortion

4. What is the name of the element found in a tetrode tube, but not in a triode vacuum tube?

   a. control grid
   b. filament
   c. screen grid
   d. cathode

5. How many elements does a tetrode vacuum tube have?

   a. 4
   b. 3
   c. 5
   d. 2

6. The capacity that exists in a triode vacuum tube between the plate and control grid is called the:

   a. capacitive resistance.
   b. interelectrode capacity.
   c. stored capacity.
   d. workable capacity.

7. What are the two main functions a power supply must do in order for an electronic circuit to operate?

   a. provide plate and cathode voltage
   b. provide grid and plate voltage
   c. provide grid and cathode voltage
   d. provide filament and plate voltage

8. What is the main disadvantage of secondary emission in a tetrode vacuum tube?

   a. increases distortion
   b. reduces distortion
   c. eliminates interelectrode capacitance
   d. reduces oscillation

9. How many elements are there in a pentode vacuum tube?

   a. 5
   b. 2
   c. 3
   d. 4

10. What is the main disadvantage of using a tetrode tube in a radio for an audio amplifier?

   a. secondary emission
   b. too much current to drop
   c. positive grid
   d. capacitance is too low

Student: ____________________ File Code: 77.03.05.02. A2-2

Date: ____________________ Date Published: 8/12/74

Mountain-Plains Education &
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Glasgow AFB, Montana 59231

LAP TEST: BUILDING AUDIO AMPLIFIERS

1. What device is used to hold the coil of a radio speaker in the center of the opening in the magnetic structure to prevent it from rubbing on the pot?

    a. magnet
    b. spider
    c. basket
    d. dust cover

2. What is the major disadvantage of using a tetrode vacuum tube as an amplifier in a radio?

    a. inefficiency
    b. distortion
    c. secondary emission
    d. non-linear operation

3. Which of the following tubes has the highest amplification factor?

    a. triode
    b. tetrode
    c. pentode
    d. diode

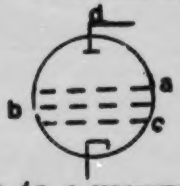
4. What is another name for the bouncing of electrons off from the plate of a vacuum tube?

    a. secondary emission
    b. deceleration
    c. demodulation
    d. emission

5. The first number or digit of a tube number refers to:

    a. power out.
    b. power in.
    c. filament voltage.
    d. amplification factor.

6. What is the element marked "B" in the following diagram?



   a. suppressor grid
   b. screen grid
   c. cathode
   d. control grid

7. What type of current ddvice is a vacuum tube when used in an audio amplifier of a radio?

   a. low
   b. negative
   c. A.C.
   d. D.C.

8. In a tetrode or pentode tube, what type of voltage must be applied to the screen grid in order to make it operate?

   a. low A.C.
   b. low D.C.
   c. high D.C.
   d. high A.C.

9. When a small signal at the grid of a vacuum tube causes a large amount of current to flow through the tube, this is called:

   a. acceleration.
   b. secondary emission.
   c. demodulation.
   d. amplification.

10. For convenience, the suppressor grid of a pentode tube is connected to the:

   a. plate.
   b. screen grid.
   c. control grid.
   d. cathode.

Student: ______________________ File Code: 77.03.05.03. A2-2
77.03.05.04. A2-2

Date: ______________________ Date Published: 8/12/74

Mountain-Plains Education &
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LAP TEST: AUDIO AMPLIFIER FUNCTIONS/TESTING THE AUDIO AMPLIFIER

1. What is the main purpose of coupling capacitors when used in radio circuits?

   a. to pass D.C.
   b. grounding the control grid
   c. to block D.C.
   d. to block A.C.

2. The bias on the grid of a vacuum tube audio amplifier must be a(n):

   a. D.C. voltage
   b. low voltage
   c. A.C. voltage
   d. high voltage

3. How effectively an audio amplifier reproduces sound depends mostly on:

   a. its power factor.
   b. its linearity.
   c. its modulation ability.
   d. the frequency response.

4. An audio output stage of a radio amplifies:

   a. voltage.
   b. current.
   c. phase inverting.
   d. resistance.

5. What is the primary function of an audio output transformer in a tube type audio amplifier?

   a. coupling
   b. A.C. blocking
   c. step-down transformer
   d. plate supply voltage

6. What component is connected to the screen grid to help ground A.C. that appears on it?

   a. bleeder
   b. by-pass capacitor
   c. coupling condensor
   d. grounding resistor

7. Any audible humming or buzzing heard in a radio audio amplifier is a basic form of:

   a. distortion.
   b. noise.
   c. response.
   d. modulation.

8. What component is placed in parallel with the bias resistor of an audio amplifier for stabilization of the output?

   a. filter capacitor
   b. coupling capacitor
   c. by-pass capacitor
   d. resistor

9. What is the first component found in an audio amplifier circuit of a radio?

   a. coupling capacitor
   b. diode
   c. volume control
   d. tube

10. What is the first component found in an audio amplifier circuit of a radio?

    a. coupling capacitor
    b. diode
    c. volume control
    d. tube

Student: ______________________ **File Code:** 77.03.05.05. A2-2
77.03.05.06. A2-2
Date: ______________________ **Date Published:** 8/12/74

Mountain-Plains Education &
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LAP TEST: DETECTOR CIRCUIT FUNCTIONS/ BUILDING A DETECTOR CIRCUIT

1. Which end of a diode is marked?

   a. the anode end
   b. the cathode end
   c. the high resistance end
   d. the low resistance end

2. Which of the following best describes distortion?

   a. the amount of ampliciation during detection
   b. noise not being amplified
   c. difference between reproduced sound and original sound transmitted
   d. can be completely eliminated

3. The most common device used for detection is:

   a. a transistor.
   b. a diode.
   c. an amplifier.
   d. a capacitor.

4. The three basic things a radio must do to signal are detect, amplify and:

   a. reject.
   b. tune.
   c. modulate.
   d. de-emphasize.

5. Why can a diode tube be used as a signal rectifier?

   a. it's a one-way current device
   b. it amplifies
   c. it uses a grid
   d. it has a high resistance path

6. A good substitute for a diode when used in detection is a:

   a. transistor.
   b. volume control.
   c. coil.
   d. capacitor.

7. Detection in a superheterodyne radio occurs:

   a. before the signal reaches the audio AMP.
   b. before the signal reaches the I.F. AMP.
   c. after the signal has reached the audio AMP.
   d. in the antenna circuit.

8. What is the purpose of the detector circuit in respect to the audio amplifier?

   a. to demodulate the signal
   b. to rectify the audio signal
   c. to remove the audio from the R.F. signal
   d. to rectify the R.F. signal

9. What part of a vacuum tube is the input signal applied to?

   a. the plate
   b. the cathode
   c. the filaments
   d. the grid

10. In a radio receiver, how many triods are needed for both detection and amplification?

   a. 1
   b. 4
   c. 2
   d. 3

File Code: 77.03.06.00.A2-1

Date Published: 11-18-75

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Learning Experience Guide

UNIT: RADIO RF SECTION

RATIONALE:

The basic section of a superheterodyne receiver is the oscillator circuit. This circuit provides selective tuning for the radio. Understanding the functions of the oscillator circuit will enable you to effectively troubleshoot and evaluate an oscillator circuit.

PREREQUISITES:

Unit: 77.03.05 - The Radio Audio Section

OBJECTIVE:

Using necessary tools, equipment and radio text/workbook:

1. Build an RF amplifier.
2. Build and test an oscillator circuit.

Identify the purpose and operation characteristics of an RF section.

RESOURCES:

Printed Materials

Basic Radio, Part 2. Heath Company, Benton Harbor, Michigan, 1960.

Equipment

Basic Radio Kit, Heathkit Model EK-2, Heathkit Company, Benton Harbor, Michigan.
Soldering iron.
Service Master Kit 99 SM or equivalent, Xcelite 99 SM Kit, Jenson Tools and Alloys, 4117 North 44th Street, Phoenix, Arizona.
Volt-Ohm meter.
Soldering tools.

Principal Author(s): P. Hoggatt

GENERAL INSTRUCTIONS:

This Unit consists of four Learning Activity Packages (LAPs). Each LAP will provide specific information for completion of a learning activity.

The general procedure for this Unit is as follows:

(1) Read the first assigned Learning Activity Package (LAP).
(2) Begin and complete the first assigned LAP.
(3) Take and score the LAP test.
(4) Turn in the LAP test answer sheet.
(5) Determine the reason for any missed items on the LAP test.
(6) Proceed to and complete the next assigned LAP in the unit.
(7) Complete all required LAPs for the unit by following steps 3 through 6.
(8) Take the unit tests as described in the Unit LEG "Evaluation Procedures".
(9) Proceed to the next assigned unit.

PERFORMANCE ACTIVITIES:

.01 Radio RF Section Function
.02 Building an RF Amplifier
.03 Oscillator Functions
.04 Testing an Oscillator Circuit

EVALUATION PROCEDURE:

When pretesting:

1. The student takes the unit multiple-choice pretest.
2. Successful completion is 4 out of 5 items for each LAP part of the pretest.
3. The student then takes a unit performance test if the unit pretest was successfully completed.
4. Satisfactory completion of the preformance test is meeting the criteria listed on the performance test.

When post testing:

1. The student takes a multiple-choice unit post test and a unit performance test.
2. Successful unit completion is meeting the listed criteria for the performance test.

FOLLOW-THROUGH:

You are now ready to begin with the first assigned LAP. If you have any questions, consult with your instructor.

Student: ______________________ File Code: 77.03.06.00. A2-2

Date: ______________________ Date Published: 9/18/75

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UNIT PRETEST: RADIO RF SECTION

77.03.06.01.

1. Which of the following is used to change the resonant frequency of a RF amplifier in a radio chassis?
   a. a coil and capacitor
   b. changing the IF frequency
   c. the tuning knob
   d. changing the resistance of the RF AMP

2. What would be a good indication of a poor RF section in an AM radio?
   a. poor station audio
   b. high noise to audio ratio
   c. oscillation
   d. distortion

3. Each time a signal goes from one RF stage to another in a RF section, the strength of this signal:
   a. becomes distorted.
   b. increases.
   c. decreases.
   d. remains the same.

4. When a RF AMP section of a radio is selecting a desired signal, what is it doing to all other signals?
   a. amplifying
   b. grounding
   c. rejecting
   d. tuning

5. In a RF section of an AM radio, the input and output frequencies must:
   a. be 455 KHZ apart.
   b. oscillate.
   c. be the same as the IF frequency.
   d. be the same.

77.03.06.02.

6. The RF section of a broadcast receiver has two functions which are to:

   a. select and amplify the proper signal.
   b. select the proper signal only.
   c. amplify the proper signal only.
   d. amplify all frequencies within the audio range.

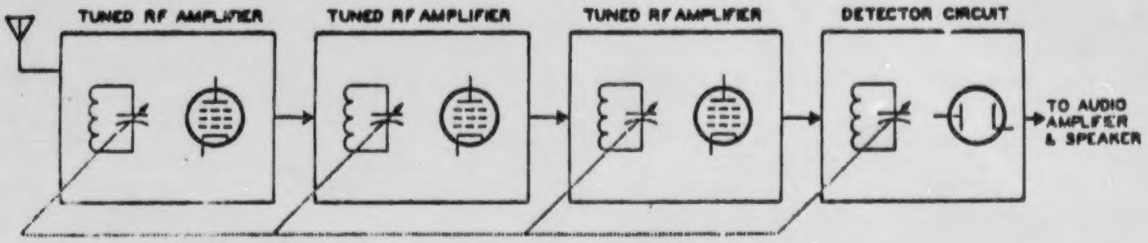
7. In a tuned resonant circuit, what amount of current flows back and forth between the coil and the capacitor?

   a. large
   b. low
   c. small
   d. weak

8. On which part of an RF amplifier tube will the resonant voltage appear?

   a. the cathode
   b. the grid
   c. the plate
   d. the power supply

9. What do the dotted lines symbolize in the illustration below?


TUNED RF AMPLIFIER
TUNED RF AMPLIFIER
TUNED RF AMPLIFIER
DETECTOR CIRCUIT
TO AUDIO AMPLIFIER & SPEAKER

   a. a trimmer capacitor
   b. an alternate circuit
   c. an old radio
   d. a ganged capacitor

10. The "nickname" of an AM radio that uses tuned RF stages is a:

   a. TRF radio.
   b. superheterodyne radio.
   c. excellent radio.
   d. high Q radio

77.03.06.03.

11. What would result if an oscillator circuit did not have an outside "push"?

    a. it would drift off frequency
    b. it would stop functioning
    c. it would lower in frequency
    d. it would raise in frequency

12. An AC signal generated by a radio's oscillator may be both RF and:

    a. regenerative.
    b. feedback.
    c. audio.
    d. DC.

13. The main purpose of an oscillator circuit in a radio oscillator is:

    a. feedback.
    b. frequency stabilization.
    c. outside voltage.
    d. dampening.

14. An oscillator in a radio circuit is used to generate:

    a. DC.
    b. audio.
    c. AC.
    d. DC frequencies.

15. What happens in an oscillator circuit when a tube reaches maximum current?

    a. the tube quits functioning
    b. drift
    c. the current stops increasing in the tickler coil
    d. the tube dampens out

77.03.06.04.

16. What happens to a superheterodyne radio when the local oscillator fails?

    a. it plays only strong stations
    b. the selectivity decreases
    c. it squeals and howls
    d. no station is received

17. The quicker method for determining whether or not an oscillator is functioning is to measure its:

    a. frequency.
    b. cathode voltage.
    c. grid-bias potential.
    d. plate potential.

18. How are oscillations made continuous in a vacuum-tube circuit?

    a. by degeneration in the grid circuit of the tube
    b. by high plate voltage on the oscillator tube
    c. by feedback from plate to grid
    d. by using a triode with a high amplification factor

19. The trimmer capacitor in an oscillator feedback circuit:

    a. changes the frequency.
    b. changes the selectivity.
    c. changes the sensitivity.
    d. matches impedance with the coil

20. When a circuit is oscillating, the rate at which the change occurs is termed the:

    a. frequency.
    b. resistance.
    c. impedance.
    d. wave-length.

UNIT PRETEST ANSWER KEY: RADIO RF SECTION

LAP		
01	1.	A
	2.	B
	3.	B
	4.	C
	5.	D
02	6.	A
	7.	A
	8.	B
	9.	D
	10.	A
03	11.	B
	12.	C
	13.	C
	14.	C
	15.	C
04	16.	C
	17.	C
	18.	C
	19.	A
	20.	A

File Code: 77.03.06.01.A2-0

Date Published: 11-18-75

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Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Radio RF Section Function

OBJECTIVE:

Identify terms commonly used in the industry to describe the operation(s) of the RF section used in a radio receiver.

EVALUATION PROCEDURE:

Successfully complete at least 80% of the items on a multiple-choice test about this LAP.

RESOURCES:

Basic Radio, Part 2, Heath Company.

PROCEDURE:

1. Read pages 55-59 in Basic Radio (Part 2).
2. Take the LAP test.

Principal Author(s): P. Schuster

LAP TEST ANSWER KEY: RADIO RF SECTION FUNCTION

1. D
2. A
3. C
4. A
5. A
6. C
7. B
8. B
9. B
10. C

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File Code: 77.03.06.02.A2-0

Date Published: 11-18-75

Learning Activity Package

Student: ____________

Date: ____________

PERFORMANCE ACTIVITY: Building an RF Amplifier

OBJECTIVE:

Given parts, equipment and supplies; assemble an RF amplifier according to the manufacturer's specifications and following the procedures described in the text Basic Radio, Part 2.

EVALUATION PROCEDURE:

Assembly is evaluated at the end of this unit.

Successfully complete at least 80% of the items on a multiple-choice test about this LAP.

RESOURCES:

Basic Radio, Part 2, Heath Company.

Heath Kit EK - 2B.
Hand tools.
Soldering iron.
Soldering tools.

PROCEDURE:

1. Read pages 59-64 in Basic Radio (Part 2).
2. Build an RF amplifier following the steps on pages 59-63.
3. Do experiment 1 described on page 62.
4. Answer the questions on page 64.
5. Check answers with the key on page 120.
6. Take the LAP test.

Principal Author(s): P. Schuster

LAP TEST ANSWER KEY: BUILDING AN RF AMPLIFIER

1. C
2. A
3. A
4. A
5. D
6. D
7. A
8. D
9. C
10. C

File Code: 77.03.06.03.A2-0

Date Published: 11-18-75

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Glasgow AFB, Montana 59231

Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Oscillator Functions

OBJECTIVE:

Identify terms commonly used in the industry to describe the operation(s) of an oscillator used in a radio receiver.

EVALUATION PROCEDURE

Successfully complete at least 80% of the items on a multiple-choice test about this LAP.

RESOURCES:

Basic Radio, Part 2, Heath Company.

PROCEDURE:

1. Read pages 65-70 in Basic Radio (Part 2).
2. Take the LAP test.

Principal Author(s): P. Schuster

LAP TEST ANSWER KEY: OSCILLATOR FUNCTIONS

1. C
2. A
3. A
4. D
5. A
6. B
7. A
8. B
9. A
10. B

File Code: 77.03.06.04.A2-0

Date Published: 11-18-75

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Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Testing an Oscillator Circuit

OBJECTIVE:

Given parts, equipment, and supplies; assemble according to the manufacturer's specifications, test, and record characteristics of operation for an oscillator circuit following the procedures described in the text, Basic Radio, Part 2.

EVALUATION PROCEDURE:

Assembly is evaluated at the end of this Unit.

Successfully complete at least 80% of the items on a multiple-choice test about this LAP.

RESOURCES:

Basic Radio, Part 2, Heath Company.

Heath Kit EK - 2B.
Hand tools.
Soldering iron.
Soldering tools.
Volt-Ohm meter.

PROCEDURE:

1. Read pages 71-78 in Basic Radio (Part 2).
2. Build an oscillator circuit following the steps on pages 71-76.
3. Perform experiments described on pages 75 and 76.
4. Answer questions on page 78.
5. Check answers with key on page 120.
6. Take LAP test.

Principal Author(s): P. Schuster

LAP TEST ANSWER KEY: TESTING AN OSCILLATOR CIRCUIT

1. D
2. B
3. B
4. A
5. C
6. A
7. A
8. A
9. C
10. B

Student: ____________________ File Code: 77.03.06.00. B2-2

Date: ____________________ Date Published: 7/29/75

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UNIT POST TEST: RADIO RF SECTION

77.03.06.01.

1. In a radio receiver, the main function of the RF section is to tune and:

    a. modulate the signal.
    b. select the signal.
    c. detect the signal.
    d. amplify the signal.

2. To check the resonance in the first RF amplifier, one would use:

    a. an ammeter.
    b. a voltmeter.
    c. an oscilloscope.
    d. a signal generator.

3. In a resonant circuit of an AM radio, which component normally changes the resonant frequency of the RF AMP section?

    a. a tube
    b. a variable capacitor
    c. a variable coil
    d. a coupling capacitor

4. The term used to describe how efficiently a radio receiver will tune in a weak signal is called:

    a. selectivity.
    b. sensitivity.
    c. superheterodyne.
    d. fine tuning.

5. What is the technical name for the variable capacitor used in the RF section of a radio?

    a. ganged
    b. cored
    c. banded
    d. resonant capacitor

77.03.06.02.

6. A low Q coil in a RF amplifier will work well at the:

   a. high end and poorly at the low end.
   b. low end and poorly at the low end.
   c. low end and poorly at the high end.
   d. high end and poorly at the high end.

7. What is the major disadvantage of using a ganged, variable capacitor in a radio's RF amplifier?

   a. too many trimmers.
   b. low selectivity.
   c. low sensitivity.
   d. cost.

8. The trimmer capacitor in a radio's RF section is used:

   a. for better tuning.
   b. for oscillation.
   c. to get a "ganged" capacitor.
   d. for coupling.

9. A high Q coil in a RF amplifier will work well at the:

   a. high end and poorly at the low end.
   b. low end and poorly at the low end.
   c. low end and poorly at the high end.
   d. high end and poorly at the high end.

10. Which of the following is produced in the coils of an RF amplifier's circuit and is one of the major difficulties in TRF radios as well?

   a. voltage drop
   b. radiation
   c. heat
   d. current

77.03.06.03.

11. What is the name of the coil found in most oscillator circuits that provides the feedback energy?

    a. flyback
    b. tickler
    c. secondary
    d. primary

12. How is the energy for feedback transferred from one coil to another in a radio oscillator circuit?

    a. by a capacitor
    b. by wire
    c. by resistance
    d. by transformer action

13. What piece of test equipment is used to check the RF circuits in a radio receiver?

    a. a RF generator
    b. a regenerative circuit
    c. a diode
    d. an audio generator

14. How does the tickler coil couple energy back into the coil of the tuned circuit of an oscillator?

    a. by the energy given off by the oscillator
    b. by the tickler coil's magnetic field
    c. by the tickler coil's core
    d. by the number of turns of wire that make up the tickler coil

15. In electronic applications, the adjustments on a signal generator are used for:

    a. adjusting the frequency.
    b. zeroing.
    c. looks.
    d. calibration.

77.03.06.04.

16. The vacuum tube of an oscillator functions as:

    a. a power supply.
    b. a frequency control.
    c. an electronic switch.
    d. a degenerative feedback path.

17. What piece of test equipment is used to measure the frequency of an oscillator?

    a. a regenerative diode
    b. an oscilloscope
    c. a V.O.M.
    d. a signal generator

18. The local oscillator frequency of a broadcast band receiver is:

    a. the same frequency as the incoming frequency.
    b. equal to the sum of the incoming frequency plus the IF frequency.
    c. the same as the IF frequency.
    d. lower in frequency than the incoming frequency.

19. What type of receivers use oscillators?

    a. crystal
    b. TRF
    c. superheterodyne
    d. regenerative-detector

20. In radios, oscillators are different than audio amplifiers because of:

    a. tube amplification factor.
    b. the power supply voltage.
    c. the type of tube used.
    d. feedback.

UNIT POST TEST ANSWER KEY: RADIO RF SECTION

LAP		
01	1.	D
	2.	C
	3.	B
	4.	A
	5.	A
02	6.	C
	7.	D
	8.	A
	9.	A
	10.	C
03	11.	B
	12.	D
	13.	A
	14.	B
	15.	A
04	16.	C
	17.	B
	18.	B
	19.	C
	20.	D

Student: ____________________ File Code: 77.03.06.00.A1-5

Date: ____________________ Date Published: 11/25/75

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Glasgow AFB, Montana 59231

Family Pay Number: __________ Sex: M F (Circle 1)

UNIT PERFORMANCE TEST: RADIO RF SECTION

OBJECTIVE:

Given parts (Heathkit EK-2B), equipment, and supplies, assemble an R-F amplifier in a superheterodyne set according to the manufacturer's specifications and following the procedures in the text, Basic Radio, Part 2, pp. 59-63.

TASK:

The student will be given components, tools and equipment to assemble a radio frequency amplifier.

ASSIGNMENT:

CONDITIONS:

The student will be tested in an environment similar to that of a radio-TV repair shop. He will be supplied with the same tools and reference manuals normally available to radio-TV service persons. He may receive no assistance from other students or the instructor.

RESOURCES:

Basic Radio, Part 2, Heath Co., 1961.

Heathkit, Model EK-2B, Heath Co., 1961.

Soldering iron, needle nose pliers, nut driver set, screwdrivers, 6" crescent wrench.

Student: ____________________ File Code: 77.03.06.00.A1-5

Date: ____________________ Date Published: 11-14-74

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Glasgow AFB, Montana 59231

Family Pay Number: __________ Sex: M F (Circle 1)

PERFORMANCE CHECKLIST:

OVERALL PERFORMANCE: Satisfactory_____ Unsatisfactory_____

	CRITERION	
	Met	Not Met
Objective 1:		
1. Proper solder techniques.		
Criterion: Basic Radio, Part 2, Page VIII.		
2. Proper placement of components.		
Criterion: Basic Radio, Part 2, Page 61.		
3. Proper wiring installed.		
Criterion: Basic Radio, Part 2, Page 61.		
4 Tubes and lamp light when voltage is applied.		
Criterion: Basic Radio Part 1, Pages 49 and 79.		
Part 2, p. 16.		
5. Successful completion of the circuit evaluation.		
Criterion: Basic Radio, Part 2, Page 62.		
6. Follows safety procedures.		
Criterion: Basic Radio, Part 2, Page 16.		
7. Temporary type lap joints used when applicable.		

(Checklist continued)

	CRITERION	
	Met	Not Met
Criterion: Basic Radio, Part 1, pp. 47 and 49.		
Part 2, pp. VIII.		
8. Task completed in allotted time.		
Criterion: Doesn't exceed 5 hours.		
Student must meet criterion on 6 line items to obtain an over-		
all score of satisfactory.		

Student: ______________________ **File Code:** 77.03.06.01. A2-2

Date: ______________________ **Date Published:** 8/12/74

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LAP TEST: RADIO RF SECTION FUNCTION

1. In a radio chassis, the signal is fed to which of the following grids of a RF amplifier's pentode tube?

   a. screen grid
   b. cathode
   c. suppressor grid
   d. control grid

2. What determines the frequency of RF AMP will select to amplify?

   a. the resonant frequency
   b. a tuneable coil
   c. the IF of the radio
   d. a tuneable capacitor

3. In a radio receiver, the main function of the RF section is to tune and:

   a. detect the signal.
   b. modulate the signal.
   c. amplify the signal.
   d. select the signal.

4. What is decreased each time an RF AMP section is added to an AM radio?

   a. the frequency response
   b. oscillation
   c. selectivity
   d. sensitivity

5. When a RF AMP section of a radio is selecting a desired signal, what is it doing to all other signals?

   a. rejecting
   b. amplifying
   c. grounding
   d. tuning

6. What would be a good indication of a poor RF section in an AM radio?

   a. distortion
   b. oscillation
   c. high noise to audio ratio
   d. poor station audio

7. What is the technical name for the variable capacitor used in the RF section of a radio?

   a. banded
   b. ganged
   c. cored
   d. resonant capacitor

8. Each time a signal goes from one RF stage to another in a RF section, the strength of this signal:

   a. remains the same.
   b. increases.
   c. becomes distorted.
   d. decreases.

9. In a resonant circuit of an AM radio, which component normally changes the resonant frequency of the RF AMP section?

   a. a coupling capacitor
   b. a variable capacitor
   c. a variable coil
   d. a tube

10. The term used to describe how efficiently a radio receiver will tune in a weak signal is called:

    a. superheterodyne.
    b. fine tuning.
    c. selectivity.
    d. sensitivity.

Student: ______________________ File Code: 77.03.06.02. A2-2

Date: ______________________ Date Published: 10/13/75

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LAP TEST: BUILDING AN RF AMPLIFIER

1. What is the major disadvantage of using a ganged, variable capacitor in a radio's RF amplifier?

   a. low sensitivity
   b. low selectivity
   c. cost
   d. too many trimmers

2. The "nickname" of an AM radio that uses tuned RF stages is a(n):

   a. TRF radio.
   b. superheterodyne radio.
   c. excellent radio.
   d. high Q radio.

3. Which of the following symbols is used to indicate a circuit or coil with a high efficient factor in a RF amplifier?

   a. Q
   b. K
   c. S
   d. M

4. On which part of an RF amplifier tube will the resonant voltage appear?

   a. the grid
   b. the cathode
   c. the plate
   d. the power supply

5. Which of the following is produced in the coils of an RF amplifier's circuit and is one of the major difficulties in TRF radios as well?

   a. current
   b. radiation
   c. voltage drop
   d. heat

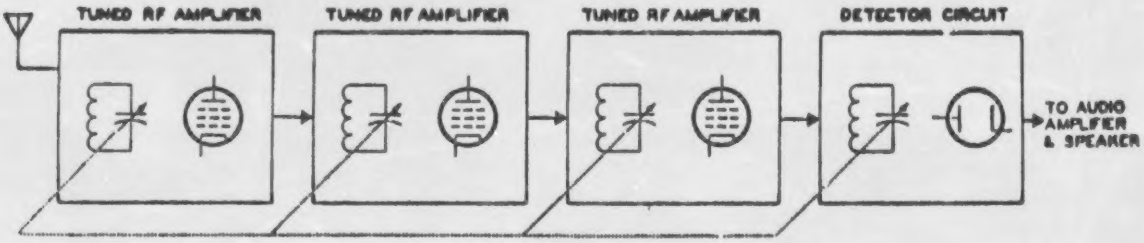
6. A low Q coil in a RF amplifier will work well at the:

   a. high end and poorly at the high end.
   b. high end and poorly at the low end.
   c. low end and poorly at the high end.
   d. low end and poorly in the middle.

7. The trimmer capacitor in a radio's RF section is used:

   a. for better tuning.
   b. for oscillation.
   c. for coupling.
   d. to get a "ganged" capacitor.

8. What do the dotted lines symbolize in the illustration below?


TUNED RF AMPLIFIER
TUNED RF AMPLIFIER
TUNED RF AMPLIFIER
DETECTOR CIRCUIT
TO AUDIO AMPLIFIER & SPEAKER

   a. a trimmer capacitor
   b. an old radio
   c. an alternate circuit
   d. a ganged capacitor

9. What amount of current at the resonant frequency is required from an external source in order to keep it going as in a RF amplifier circuit?

   a. large
   b. low Q
   c. small
   d. 1.5 v

10. In a tuned resonant circuit, what amount of current flows back and forth between the coil and the capacitor?

   a. small
   b. weak
   c. large
   d. low

Student: ______________________ File Code: 77.03.06.03. A2-2

Date: ______________________ Date Published: 7/25/75

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LAP TEST: OSCILLATOR FUNCTIONS

1. What happens in an oscillator circuit when a tube reaches maximum current?

   a. the tube dampens out
   b. the tube quits functioning
   c. the current stops in the tickler coil
   d. drift

2. How does the tickler coil couple energy back into the coil of the tuned circuit of an oscillator?

   a. by the tickler coil's magnetic field
   b. by the number of turns of wire that made up the tickler coil
   c. by the tickler coil's core
   d. by the energy given off by the oscillator

3. What would result if an oscillator circuit did not have an outside "push"?

   a. it would stop functioning.
   b. it would raise in frequency
   c. it would lower in frequency
   d. it would drift off frequency

4. What occurs when a maximum amount of current flows through a tube in an electronic circuit?

   a. emission
   b. ionization
   c. secondary emission
   d. saturation

5. An oscillator circuit will keep oscillating, because it:

   a. pulses new energy into the tuned circuit every cycle.
   b. provides feedback to the tuned circuit every other cycle.
   c. superheterodynes the tuned circuit every cycle.
   d. dampens the tuned circuit every other cycle.

6. What does the term "oscillate" mean?

    a. to go up and down
    b. to swing back and forth
    c. to build and collapse
    d. a frequency

7. Oscillation in an electronic application is used:

    a. inmjust about everything electronic.
    b. by an ammeter.
    c. by a voltmeter.
    d. by a vtvm.

8. An AC signal generated by a radio's oscillator may be both RF and:

    a. regenerative.
    b. audio.
    c. D.C.
    d. feedback.

9. What piece of test equipment is used to check the RF circuits in a radio receiver?

    a. a RF generator
    b. an audio generator
    c. a diode
    d. a regenerative circuit

10. What is the name of the coil found in most oscillator circuits that provides the feedback energy?

    a. secondary
    b. tickler
    c. flyback
    d. primary

Student: ____________________ File Code: 77.03.06.04. A2-2

Date: ____________________ Date Published: 8/13/74

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LAP TEST: TESTING AN OSCILLATOR CIRCUIT

1. In radios, oscillators are different than audio amplifiers because of:

   a. the power supply voltage.
   b. the type of tube used.
   c. tube amplification factor.
   d. feedback.

2. The quickest method for determining whether or not an oscillator is functioning is to measure its:

   a. plate potential.
   b. grid-bias potential.
   c. frequency.
   d. cathode voltage.

3. The RF ground in an oscillator must be placed at:

   a. the plate.
   b. the grid.
   c. the cathode.
   d. any element.

4. What happens to a superheterodyne radio when the local oscillator fails?

   a. it squeals and howls
   b. no station is received
   c. it plays only strong stations
   d. the selectivity decreases

5. The vacuum tube of an oscillator functions as:

   a. a degenerative feedback path.
   b. a frequency control.
   c. an electronic switch.
   d. a power supply.

6. What type of receivers use oscillators?

   a. superheterodyne
   b. regenerative-detector
   c. TRF
   d. crystal

7. The local oscillator frequency of a broadcast band receiver is:

   a. equal to the sum of the incoming frequency plus the IF frequency.
   b. the same frequency as the incoming frequency.
   c. the same as the IF frequency.
   d. lower in frequency than the incoming frequency.

8. A circuit that generates an unmodulated AC voltage at a desired frequency is a:

   a. oscillator.
   b. detector.
   c. demodulator.
   d. mixer.

9. What piece of test equipment is used to measure the frequency of an oscillator?

   a. a V.O.M.
   b. a regenerative diode
   c. an oscilloscope
   d. a signal generative

10. The trimmer capacitor in an oscillator feedback circuit:

    a. changes the sensitivity.
    b. changes the frequency.
    c. matches impedance with the coil.
    d. changes the selectivity.

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Date Published: 11-18-75

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Learning Experience Guide

UNIT: SUPERHETERODYNE RECEIVERS

RATIONALE:

The superheterodyne receiver is the standard type of radio. The radio service person will be wroking with the superheterodyne receiver. Knowledge about the superheterodyne circuits is therefore essential to basic techniques for troubleshooting and alignment of the radio. Circuit organization and characteristics are reinforced by constructing a superheterodyne receiver.

PREREQUISITES:

Unit: 77.03.06 - The Radio RF Section

OBJECTIVES:

Using necessary tools, equipment and radio text/workbook:

1. Build and align a superheterodyne receiver.
2. Build and align short wave and heat frequency oscillators.

Identify the function and reason for alignment of a superheterodyne converter circuit.

Describe the characteristics of short wave signals.

RESOURCES:

Printed Materials

Basic Radio, Part 2, Heath Company, Benton Harbor, Michigan, 1960.

Equipment

Alignment tool set.
Basic Radio Kit, Heathkit Model EK-2, Heathkit Company, Benton Harbor, Michigan.
RF signal generator.
Soldering iron.
Service Master Kit 99 SM or equivalent Xcelite 99 SM Kit, Jenson Tools and Alloys, 4117 North 44th Street, Phoenix, Arizona.
Vacuum tube volt meter.
Soldering tools.

Principal Author(s): P. Hoggatt

GENERAL INSTRUCTIONS:

This Unit consists of six Learning Activity Packages (LAPs). Each LAP will provide specific information for completion of a learning activity.

The general procedure for this Unit is as follows:

(1) Read the first assigned Learning Activity Package (LAP).
(2) Begin and complete the first assigned LAP.
(3) Take and score the LAP test.
(4) Turn in the LAP test answer sheet.
(5) Determine the reason for any missed items on the LAP test.
(6) Proceed to and complete the next assigned LAP in the unit.
(7) Complete all required LAPs for the unit by following steps 3 through 6.
(8) Take the unit tests as described in the Unit LEG "Evaluation Procedures".
(9) Proceed to the next assigned unit.

PERFORMANCE ACTIVITIES:

.01 Converter Circuit Functions
.02 Building a Superheterodyne Receiver
.03 Receiver Alignment
.04 Aligning a Superheterodyne Receiver
.05 Short Wave Signals
.06 Building Short Wave and Beat Frequency Oscillators.

EVALUATION PROCEDURE:

When pretesting:

1. The student takes the unit multiple-choice pretest.
2. Successful completion is 4 out of 5 items for each LAP part of the pretest.
3. The student then takes a unit performance test if the unit pretest was successfully completed.
4. Satisfactory completion of the performance test is meeting the criteria listed on the performance test.

When post testing:

1. The student takes a multiple-choice unit post test and a unit performance test.
2. Successful unit completion is meeting the listed criteria for the performance test.

FOLLOW-THROUGH:

After completing this guide, begin with the first assigned LAP in the Unit.

Student: ______________________ File Code: 77.03.07.00. A2-2

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UNIT PRETEST: SUPERHETERODYNE RECEIVERS

77.03.07.01.

1. The I.F. amplifier in a superheterodyne receiver is tuned to what frequency?

   a. 60kc
   b. 1200kc
   c. 1655kc
   d. 455kc

2. What are two disadvantages of a TRF radio?

   a. a converter and TRF
   b. a low Q coil and a trimmer
   c. a high Q coil and a trimmer
   d. a variable capacitor and a low Q coil

3. What does the arrow symbolize in the primary and secondary windings of a R.F. or I.F. AMP transformer?

   a. direction of windings
   b. a variable iron core
   c. they are installed in this direction
   d. requires a special tool for alignment

4. In radio terminology, AVC means:

   a. automatic volume control.
   b. DC voltage.
   c. automatic listening device.
   d. automatic variable control.

5. The signal that is incoming to the I.F. amplifier from the converter contains:

   a. oscillations.
   b. broadcast signals.
   c. sine waves.
   d. audio modulation.

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6. The frequency difference between the tuning for the input tuned circuit and the oscillator tuned circuit should always be:

   a. 455kc.
   b. the same as the signal generator.
   c. the same as the local oscillator.
   d. 1200kc.

7. The signal from the oscillator circuit and the signal from the input tuned circuit mix in the pentagrid converter. As a result of their mixing action, how many different signals are present in the plate circuit of the converter tube?

   a. 2
   b. 3
   c. 4
   d. 1

8. A smaller input signal to the R.F. AMP will consequently result in:

   a. a higher AVC voltage.
   b. o AVC voltage.
   c. lower AVC voltage.
   d. no change.

9. Which of the following parts of a pentogrid and pentode tube is AVC voltage applied to?

   a. control grid
   b. plate
   c. screen grid
   d. cathode

10. What should one use to align an IF amplifier in a superheterodyne radio?

   a. a voltmeter
   b. a signal generator
   c. an audio generator
   d. an AVC bias

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11. In a block diagram, which circuit is next in line from the IF amplifier?

    a. detector
    b. AVC
    c. local oscillator
    d. audio output

12. What is the first step one should take when aligning a radio receiver?

    a. turn the radio on
    b. let all equipment warm up properly
    c. turn the instruments on
    d. positioning the pointer

13. The trimmer capacitor for the input tuned circuit and the oscillator tuned circuit are adjusted at:

    a. the low end of the broadcast band.
    b. 455kc.
    c. the high end of the broadcast band.
    d. the middle of the broadcast band.

14. In a superheterodyne radio, on which component of the converter tube does the four frequencies usually appear?

    a. grid
    b. cathode
    c. AVC
    d. plate

15. The input tuned circuit and the oscillator tuned circuit must be adjusted so there is always what frequency between them?

    a. the incoming signal
    b. 455kc
    c. the incoming signal plus 455 kc
    d. 1200kc

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16. When aligning a superheterodyne radio, the signal generator is connected to the:

    a. antenna terminals.
    b. IF AMP .
    c. oscillator.
    d. AVC filter.

17. In a superheterodyne receiver, if the incoming frequency is 800 KHZ and the local oscillator is 1162 KHZ, the IF should be tuned to:

    a. 362 KHZ.
    b. 800 KHZ.
    c. 1162 KHZ.
    d. 455 KHZ.

18. In an IF transformer **having separate** primary and secondary coils, the secondary is tuned to:

    a. twice the primary frequency.
    b. one-half the frequency of the R.F. frequency.
    c. the same frequency as the local oscillator.
    d. the same frequency as the primary.

19. When aligning a superheterodyne receiver, one should start with the:

    a. IF transformer nearest the RF section.
    b. padder capacitor.
    c. RF oscillator-tuning coil slug.
    d. trimmer capacitor on the tunning capacitor.

20. When aligning a receiver and a voltmeter is connected across the AVC filter, what type of voltage is being adjusted?

    a. peak-to-peak
    b. RMS
    c. negative
    d. positive

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21. What is the frequency of the audio heard in a short wave radio using a BFO?

    a. 455kc
    b. 456kc
    c. 10000HZ
    d. 544kc

22. What frequency is the 40 meter band close to?

    a. 7 MHZ
    b. 40 MHZ
    c. 4 MHZ
    d. 6 MHZ

23. The signal of the BFO is coupled to the:

    a. grid of the detector.
    b. grid of the mixer-oscillator.
    c. grid of the R.F. AMP.
    d. grid of the IF AMP.

24. How long is a wave length of a signal at 6 MHZ?

    a. 75 meters
    b. 100 meters
    c. 50 meters
    d. 36 meters

25. What is the purpose of station WWV?

    a. frequency and time signals
    b. music
    c. airplane navigational information
    d. F.M.

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26. What does CW stand for in signal characteristics?

    a. code wave
    b. clear wave
    c. continuous wave
    d. clean amplification

27. What is the wave length of 3 MHZ?

    a. 1500 meters
    b. 100 meters
    c. 50 meters
    d. 200 meters

28. Most of RF gain of a superheterodyne receiver is produced in the:

    a. detector.
    b. IF amplifier.
    c. RF amplifier.
    d. converter.

29. The stages which are found in a superheterodyne receiver, but not in a TRF are:

    a. local oscillator, mixer and IF amplifier.
    b. converter, detector, and power supply.
    c. RF AMP, detector, and mixer.
    d. local oscillator, detector and converter.

30. To what components of a rotary band switch are the wires soldered?

    a. arms
    b. decks
    c. wafers
    d. strips

UNIT PRETEST ANSWER KEY: SUPERHETERODYNE RECEIVERS

LAP		
01	1.	D
	2.	D
	3.	B
	4.	A
	5.	D
02	6.	A
	7.	C
	8.	C
	9.	A
	10.	B
03	11.	A
	12.	D
	13.	C
	14.	D
	15.	B
04	16.	A
	17.	D
	18.	D
	19.	C
	20.	C
05	21.	C
	22.	A
	23.	D
	24.	C
	25.	A
06	26.	A
	27.	B
	28.	C
	29.	D
	30.	B

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Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Convertor Circuit Functions

OBJECTIVE:

Identify terms commonly used in the industry to describe the function(s) of a convertor circuit used in a radio receiver.

EVALUATION PROCEDURE:

Successfully complete at least 80% of the items on a multiple-choice test about this LAP.

RESOURCES:

Basic Radio, Part 2, Heath Company.

PROCEDURE:

1. Read pages 79-83 in Basic Radio (Part 2).
2. Take the LAP test.

Principal Author(s): P. Schuster

LAP TEST ANSWER KEY: CONVERTER CIRCUIT FUNCTIONS

1. A
2. C
3. C
4. A
5. B
6. B
7. C
8. A
9. A
10. A

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Learning Activity Package

Student: ______________________

Date: ______________________

PERFORMANCE ACTIVITY: Building a Superheterodyne Receiver

OBJECTIVE:

Given parts, equipment, and supplies; assemble a superheterodyne receiver according to the manufacturer's specifications and following the procedures described in the text, Basic Radio, Part 2.

EVALUATION PROCEDURE:

Assembly is evaluated at the completion of this Unit.

Successfully complete at least 80% of the items on a multiple-choice test about this LAP.

RESOURCES:

Basic Radio, Part 2, Heath Company.

Heat Kit EK - 2B.
Hand tools.
Soldering iron
Soldering tools.

PROCEDURE

1. Read pages 84-89 in Basic Radio (Part 2).
2. Build a superheterodyne receiver following steps on pages 84-87.
3. Do the experiment described on pages 88-89.
4. Answer questions on page 89.
5. Check answers with key on page 120.
6. Take the LAP test.

Principal Author(s): P. Schuster

LAP TEST ANSWER KEY: BUILDING A SUPERHETERODYNE RECEIVER

1. A
2. D
3. C
4. C
5. B
6. D
7. D
8. A
9. A
10. A

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Student: __________

Date: __________

PERFORMANCE ACTIVITY: Receiver Alignment

OBJECTIVE:

Describe the procedures for using electronic test equipment when aligning a superheterodyne receiver.

Describe the procedures when not using electronic test equipment for alignment of a superheterodyne receiver.

EVALUATION PROCEDURE:

Successfully complete at least 80% of the items on a multiple-choice test about this LAP.

RESOURCES:

Basic Radio, Part 2, Heath Company.

PROCEDURE:

1. Read pages 90-97 in Basic Radio (Part 2).
2. Take the LAP test.

Principal Author(s): P. Schuster

LAP TEST ANSWER KEY: RECEIVER ALIGNMENT

1. B
2. D
3. B
4. A
5. D
6. B
7. C
8. C
9. C
10. B

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Learning Activity Package

Student: ____________

Date: ____________

PERFORMANCE ACTIVITY: Aligning a Superheterodyne Receiver

OBJECTIVE:

Given equipment and supplies, align a superheterodyne receiver according to the manufacturer's specifications and following the procedures described in the text, Basic Radio, Part 2.

EVALUATION PROCEDURE:

Alignment procedure is evaluated on the unit performance test.

Successfully complete at least 80% of the items on a multiple-choice test about this LAP.

RESOURCES:

Basic Radio, Part 2, Heath Company.

Heath Kit EK - 2B
Alignment tool set
Hand tools
Vacuum tube
Volt-Ohm meter
RF signal generator

PROCEDURE:

1. Read pages 97-99 in Basic Radio (Part 2).
2. Align the superheterodyne receiver following the steps on pages 97-98.
3. Answer questions on page 99.
4. Check answers with the key on page 121.
5. Take the LAP test.

Principal Author(s): P. Schuster

LAP TEST ANSWER KEY: ALIGNING A SUPERHETERODYNE RECEIVER

1. D
2. B
3. B
4. B
5. C
6. D
7. D
8. D
9. D
10. C

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Learning Activity Package

Student: __________

Date: __________

PERFORMANCE ACTIVITY: Short Wave Signals

OBJECTIVE:

Describe the characteristics of a short wave signal.

EVALUATION PROCEDURE:

Successfully complete at least 80% of the items on a multiple-choice test about this LAP.

RESOURCES:

Basic Radio, Part 2, Heath Company.

PROCEDURE:

1. Read pages 100-106 in Basic Radio (Part 2).
2. Take the LAP test.

Principal Author(s): P. Schuster

LAP TEST ANSWER KEY: SHORT WAVE SIGNALS

1. D
2. D
3. C
4. B
5. D
6. A
7. A
8. B
9. C
10. C

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Learning Activity Package

Student:

Date:

PERFORMANCE ACTIVITY: Building Short Wave and Beat Frequency Oscillators

OBJECTIVE:

Given parts, equipment, and supplies; assemble and align oscillators for short wave band and continuous wave reception according to the manufacturer's specifications and following the procedures described in the text, Basic Radio, Part 2.

EVALUATION PROCEDURE:

Assembly and alignment are evaluated on the unit performance test.

Successfully complete at least 80% of the items on a multiple-choice test about this LAP.

RESOURCES:

Basic Radio, Part 2, Heath Company.

Heath Kit EK - 2B.

PROCEDURE:

1. Read pages 106-115 in Basic Radio (Part 2).
2. Build oscillator circuits for short wave and continuous wave reception following the steps on pages 106-112.
3. Perform experiments 1 and 2 described on pages 113 and 114.
4. Answer questions on page 116.
5. Check answers with key on page 121.
6. Take the LAP test.

Principal Author(s): P. Schuster

LAP TEST ANSWER KEY: BUILDING SHORT WAVE AND BEAT FREQUENCY OSCILLATORS

1. D
2. A
3. A
4. B
5. C
6. B
7. B
8. A
9. B
10. D

Student: ____________________ **File Code:** 77.03.07.00. B2-2

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UNIT POST TEST: SUPERHETERODYNE RECEIVERS

77.03.07.01.

1. What is the frequency difference between the local oscillator and the incoming signal?

   a. one cannot tell due to lack of information
   b. 1200 kc
   c. they are the same as the IF frequency
   d. 1655 kc

2. Why can a high Q coil be used in the IF amplifier of a superheterodyne radio?

   a. because of the single frequency of the IF
   b. utilizes a local oscillator
   c. better signal strength
   d. high frequency input

3. What is the IF AMP input frequency in a superheterodyne receiver?

   a. 4.55 HZ
   b. 455 MHZ
   c. 455 KHZ
   d. 45.5 KHZ

4. What type of tube may be used in the radio mixer circuit?

   a. pentode
   b. triode
   c. pentagrid
   d. tetrode

5. What makes the input of the converter and the frequency of the local oscillator change frequency at the same time?

   a. varying the modulation
   b. a ganged capacitor
   c. varying the input frequency
   d. two coils

77.03.07.02.

6. What does the AVC circuit do to the sensitivity of a superheterodyne receiver?

   a. increase it
   b. decrease it
   c. keeps it constant
   d. removes the noise

7. What is the purpose of the AVC circuit in a radio chassis?

   a. to control the RF signal
   b. to control the grid bias
   c. to strengthen the signal
   d. to control amplification

8. Does the volume control of a superheterodyne radio have any effect on the AVC voltage?

   a. occasionally
   b. possibly
   c. yes
   d. no

9. The main function of the AVC circuit in a superheterodyne receiver is to:

   a. keep the IF frequency constant.
   b. amplify strong signals.
   c. amplify weak signals.
   d. keep the signal to the IF input the same.

10. If the local oscillator goes dead, what will result?

    a. nothing will change
    b. there will be no output from the radio
    c. the AVC will quit
    d. the IF would not operate

77.03.07.03.

11. When aligning a receiver without using instruments, what section must be assumed to have been aligned at the factory?

    a. IF AMP
    b. oscillator
    c. converter
    d. audio output

12. Why shouldn't a metal screwdriver be used to align a radio?

    a. it will damage the radio components
    b. it will make the audio drift
    c. it will detune the radio
    d. it won't fit

13. The coil adjustments for both the oscillator circuit and the input tuned circuit are always made at:

    a. the low end of the broadcast band.
    b. the high end of the broadcast band.
    c. 455kc.
    d. the middle of the broadcast band.

14. Three circuits have to be aligned in a superheterodyne radio. They are the IF circuits, the oscillator circuit, and the:

    a. mixing circuit.
    b. RF AMP.
    c. AVC.
    d. audio drive.

15. A receiver is aligned for:

    a. best performance.
    b. customer satisfaction.
    c. best selectivity.
    d. best signal.

77.03.07.04.

16. When adjusting an IF transformer, at what frequency should the generator be set?

    a. 1755 kc
    b. 1200 kc
    c. 60 kc
    d. 455 kc

17. The trimmer of the antenna of a radio should be adjusted for:

    a. 455 kc.
    b. maximum volume.
    c. maximum AVC voltage.
    d. local station frequency.

18. Two instruments that are generally used for alignment are a RF signal generator and:

    a. a local station.
    b. a sweep generator.
    c. a voltmeter.
    d. an ohmmeter.

19. What is the frequency range in an A.M. radio?

    a. 500 - 1750 kc
    b. 455 - 1800 kc
    c. 750 - 1450 kc
    d. 550 - 1650 kc

20. When aligning a radio receiver, the test instrument (volt-meter) is usually connected to the:

    a. audio output.
    b. speaker.
    c. IF AMP.
    d. AVC filter.

77.03.07.05.

21. Which of the following lengths in English measure would be equal to one meter in the metric system?

    a. 41.21 inches
    b. 36 inches
    c. 39.37 inches
    d. 37 inches

22. What is a nickname for morse code signals?

    a. teletype
    b. CW
    c. WWV
    d. F.M.

23. What components in a radio change when the band selector is respositioned from A.M. to short wave?

    a. detector circuit
    b. antenna and oscillator circuits
    c. local oscillator
    d. IF circuit

24. What is the biggest difference between a frequency of a low value and one of a high value?

    a. the need for separate radios
    b. frequency
    c. wave-length
    d. cycles per second

25. What is the frequency of the BFO in a short wave receiver?

    a. 455 kc
    b. 456 kc
    c. the incoming signal plus 455 kc
    d. same as the incoming signal

77.03.07.06.

26. What is the biggest difference between a standard A.M. radio and a short wave radio?

    a. BFO
    b. detector
    c. antenna and oscillator
    d. IF AMP

27. The local oscillator is designed to generate a signal which is:

    a. unmodulated and equal to the IF signal frequency.
    b. modulated with 400 cycles and equal to twice the IF carrier.
    c. unmodulated and equal to the sum or difference of the RF signal frequency and the IF signal frequency.
    d. unmodulated and equal to the sum of the RF signal frequency and twice the IF signal frequency.

28. When a receiver is aligned for short wave, which component should not be realigned?

    a. AVC
    b. the detector
    c. the IF AMP
    d. the BFO

29. To what components of a rotary band switch are the wires soldered?

    a. wafers
    b. decks
    c. strips
    d. arms

30. What term expresses the ability of a receiver to select one radio station and reject another?

    a. tuneability
    b. selectivity
    c. sensitivity
    d. detectability

UNIT POST TEST ANSWER KEY: SUPERHETERODYNE RECEIVERS

LAP		
01	1.	C
	2.	A
	3.	C
	4.	C
	5.	B
02	6.	A
	7.	D
	8.	D
	9.	D
	10.	B
03	11.	A
	12.	C
	13.	A
	14.	A
	15.	A
04	16.	D
	17.	B
	18.	C
	19.	D
	20.	D
05	21.	C
	22.	B
	23.	B
	24.	C
	25.	B
06	26.	C
	27.	C
	28.	C
	29.	B
	30.	B

Student: ____________________ File Code: 77.03.07.00.A1-5

Date: ____________________ Date Published: 11/25/75

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Family Pay Number: __________ Sex: M F (Circle 1)

UNIT PERFORMANCE TEST: SUPERHETERODYNE RECEIVERS

OBJECTIVE:

Given parts (Heathkit EK-2B), equipment, and supplies, assemble a super heterodyne receiver, shortwave band and beat frequency oscillator (BFO) according to the manufacturer's specifications and following the procedures described in the text, Basic Radio, Part 2, pp. 84-115.

TASK:

The student will be given components, tools and equipment to assemble a super heterodyne and shortwave receiver.

ASSIGNMENT:

CONDITIONS:

The student will be tested in an environment similar to that of a radio-TV repair shop. He will be supplied with the same tools and reference manuals normally available to radio-TV service persons. He may receive no assistance from other students or the instructor.

RESOURCES:

Basic Radio, Part 2, Heath Co., 1961.

Heathkit, Model EK-2B, Heath Co., 1961.

Soldering iron, needle nose pliers, nut driver set, screwdrivers, 6" crescent wrench.

Student: ____________________ File Code: 77.03.07.00.A1-5

Date: ____________________ Date Published: 11-14-74

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Family Pay Number: __________ Sex: M F (Circle 1)

PERFORMANCE CHECKLIST:

OVERALL PERFORMANCE: Satisfactory_____ Unsatisfactory_____

	CRITERION	
	Met	Not Met
Objective 1:		
1. Proper solder techniques.		
Criterion: Basic Radio, Part 2, Page VIII-IX.		
2. Proper placement of components.		
Criterion: Basic Radio, Part 2, Pages III and II3.		
3. Proper wiring installed.		
Criterion: Basic Radio, Part 2, Page 110.		
4. Tubes and lamp light when voltage is applied.		
Criterion: Basic Radio, Part 1, Pages 49 and 79.		
Basic Radio, Part II, page 16.		
5. Successful completion of the circuit evaluation.		
Criterion: Basic Radio, Part 2, Page 113-114.		
6. Follows safety procedures.		
Criterion: Basic Radio, Part 2, Page 16.		
7. Temporary type lap joints used when applicable.		

(Checklist continued)

	CRITERION	
	Met	Not Met
Criterion: Basic Radio, Part 1, page 47 and 49.		
8. Task completed in allotted time.		
Criterion: Doesn't exceed 8 hours.		
Student must meet criterion on 6 line items to obtain an overall score of satisfactory.		

Student: ______________________ **File Code:** 77.03.07.01. A2-2

Date: ______________________ **Date Published:** 8/13/74

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LAP TEST: CONVERTER CIRCUIT FUNCTIONS

1. What are two disadvantages of a TRF radio?

   a. a variable capacitor and a low Q coil
   b. a low Q coil and a trimmer
   c. a high Q coil and a trimmer
   d. a converter and TRF

2. The signal that is incoming to the IF amplifier from the converter contains:

   a. oscillations.
   b. sine waves.
   c. audio modulation.
   d. broadcast signals.

3. What does the arrow symbolize in the primary and secondary windings of a RF or IF AMP transformer?

   a. direction of windings
   b. they are installed in this direction
   c. a variable iron core
   d. requires a special tool for alignment

4. One signal to be mixed comes from the radio station, the other comes from:

   a. the local oscillator.
   b. the IF amplifier.
   c. the trimmer capacitor.
   d. the RF amplifier

5. What type of tube may be used in the radio mixer circuit?

   a. tetrode
   b. pentagrid
   c. triode
   d. pentode

6. What is the frequency difference between the local oscillator and the incoming signal?

   a. 1200 kc
   b. they are the same or the IF frequency
   c. 1655 kc
   d. one cannot tell due to lack of information

7. To which stage is the radio converter next connected?

   a. detector
   b. RF AMP
   c. IF AMP
   d. oscillator

8. In radio terminology, AVC means:

   a. automatic volume control.
   b. automatic variable control.
   c. DC voltage
   d. automatic listening device.

9. The frequency of the oscillator and the frequency of the input tuned circuit are always the same number of:

   a. KHZ.
   b. HZ.
   c. MHZ.
   d. 60 HZ.

10. The IF amplifier in a superheterodyne receiver is tuned to what frequency?

   a. 455 kc
   b. 60 kc
   c. 1200 kc
   d. 1655 kc

Student: ______________________ File Code: 77.03.07.02. A2-2

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LAP TEST: BUILDING A SUPERHETERODYNE RECEIVER

1. How would one describe the signal from the converter tube that is coupled to the IF AMP in relationship to the two original signals?

   a. they differ
   b. they are the same.
   c. they are similar in respect to oscillation
   d. they compare to the frequency of the local oscillator

2. What is the function of the AVC filter in a superheterodyne radio?

   a. changes AC to DC
   b. frequency tuning
   c. coupling
   d. changes PDC to DC

3. Does the volume control of a superheterodyne radio have any effect on the AVC voltage?

   a. yes
   b. occasionally
   c. no
   d. possibly

4. The main function of the AVC circuit in a superheterodyne receiver is to:

   a. amplify weak signals.
   b. amplify strong signals.
   c. keep the volume level constant.
   d. keep the signal to the IF input the same.

5. In a superheterodyne radio, the capacitors parallel with the IF transformer are used for:

   a. sensitivity.
   b. frequency tuning.
   c. coupling.
   d. 1200 KHZ tuning.

6. Which of the following parts of a pentogrid and pentode tube is AVC voltage applied to?

   a. plate
   b. screen grid
   c. cathode
   d. control grid

7. What should one use to align an IF amplifier in a superheterodyne radio?

   a. an AVC bias
   b. an audio generator
   c. a voltmeter
   d. a signal generator

8. What does the AVC circuit do to the sensitivity of a superheterodyne receiver?

   a. increases it
   b. keeps it constant
   c. removes the noise
   d. decreases it

9. What device is used in a superheterodyne radio to couple signals in and out of an IF amplifier stage?

   a. transformer
   b. resistor
   c. capacitor
   d. iron core

10. What is the purpose of the AVC circuit in a radio chassis?

   a. to control amplification
   b. to strengthen the signal
   c. to control the RF signal
   d. to control the grid bias

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LAP TEST: RECEIVER ALIGNMENT

1. When aligning a receiver without using instruments, what section must be assumed to have been aligned at the factory?

   a. audio output
   b. IF AMP
   c. converter
   d. oscillator

2. The trimmer capacitor for the input tuned circuit and the oscillator tuned circuit are adjusted at:

   a. the middle of the broadcast band.
   b. 455 kc.
   c. the low end of the broadcast band.
   d. the high end of the broadcast band.

3. What is the first step one should take when aligning a radio receiver?

   a. turn the instruments on
   b. position the pointer
   c. turn the radio on
   d. let all equipment warm up properly

4. If a station is tuned in at 1300 kc and the local oscillator is operating, what is the frequency in the second IF amplifier?

   a. 455 kc
   b. 1755 kc
   c. 1300 kc
   d. 844 kc

5. In a superheterodyne radio, on which component of the converter tube does the four frequencies usually appear?

   a. grid
   b. cathode
   c. AVC
   d. plate

6. The coil adjustments for both the oscillator circuit and the input tuned circuit are always made at:

   a. the high end of the broadcast band.
   b. the low end of the broadcast band.
   c. the middle of the broadcast band.
   d. 455 kc.

7. In a block diagram, which circuit is next in line from the IF amplifier?

   a. audio output
   b. AVC
   c. detector
   d. local oscillator

8. Three circuits have to be aligned in a superheterodyne radio. They are the IF circuits, the oscillator circuit, and the:

   a. R.F. AMP.
   b. AVC.
   c. mixing circuit.
   d. audio drive.

9. A receiver is aligned for:

   a. best signal.
   b. best selectivity.
   c. best performance.
   d. customer satisfaction.

10. You are about to align a receiver. This means you are about to adjust the:

    a. AVC.
    b. R.F. signal.
    c. negative voltage.
    d. audio signal.

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LAP TEST: ALIGNING A SUPERHETERODYNE RECEIVER

1. When adjusting an IF transformer, at what frequency should the generator be set?

   a. 1200 kc
   b. 60 kc
   c. 1755 kc
   d. 455 kc

2. In an IF transformer having separate primary and secondary coils, the secondary is tuned to:

   a. twice the primary frequency.
   b. the same frequency as the primary.
   c. one-half the frequency of the R.F. frequency.
   d. the same frequency as the local oscillator.

3. When aligning a superheterodyne radio, the signal generator is connected to the:

   a. oscillator.
   b. antenna terminals.
   c. IF AMP.
   d. AVC filter.

4. The mixer stage in a superheterodyne radio receives signals from:

   a. the oscillator and the IF AMP.
   b. the oscillator and antenna.
   c. the antenna and the I.F. AMP
   d. the detector and the oscillator.

5. Two instruments that are generally used for alignment are a R.F. signal generator and:

   a. sweep generator.
   b. a local station.
   c. a voltmeter.
   d. an ohmmeter.

6. Trimmer capacitors are used on ganged tuning capacitors to:

   a. eliminate the necessity of shielding.
   b. prevent oscillation.
   c. prevent feedback from plate to grid.
   d. overcome slight discrepancies in tuning capacity.

7. What is the frequency range in an A.M. radio?

   a. 455 - 1800 kc
   b. 500 - 1750 kc
   c. 750 - 1450 kc
   d. 550 - 1650 kc

8. The trimmer of the antenna of a radio should be adjusted for:

   a. local station frequency.
   b. maximum AVC voltage.
   c. 455 kc
   d. maximum volume.

9. When aligning a superheterodyne receiver, one should start with the:

   a. I.F. transformer nearest the R.F. section.
   b. trimmer capacitor on the tuning capacitor.
   c. padder capacitor.
   d. R.F. oscillator-tuning coil slug.

10. The top and bottom slug of each I.F. transformer should be adjusted for:

   a. local station frequency.
   b. maximum volume.
   c. 455 kc.
   d. AVC voltage.

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LAP TEST: SHORT WAVE SIGNALS

1. Where does the mixing or beating process take place in a short wave receiver using a BFO?

   a. detector
   b. mixer oscillator
   c. converter
   d. I.F. AMP

2. What is the frequency of the audio heard in a short wave radio using a BFO?

   a. 455 KC
   b. 544 KC
   c. 456 KC
   d. 1000 HZ

3. What frequency is the 40 meter band close to?

   a. 4 MHZ
   b. 40 MHZ
   c. 7 MHZ
   d. 6 MHZ

4. The selector on a radio which changes one range of frequencies to another is called the:

   a. selector knob.
   b. band switch.
   c. fine tuner.
   d. turner.

5. Which of the following lengths in English measure would be equal to one meter in the metric system?

   a. 36 inches
   b. 37 inches
   c. 41.21 inches
   d. 39.37 inches

6. What is a nickname for morse code signals?

   a. CW
   b. teletype
   c. WWV
   d. F.M.

7. What components in a radio change when the band selector is respositioned from A.M. to short wave?

   a. antenna and oscillator circuits.
   b. local oscillator
   c. detector circuit
   d. I.F. circuit

8. What is the biggest difference between a frequency of a low value and one of a high value?

   a. speed
   b. wave-length
   c. the need for separate radios
   d. frequency

9. The device which is needed to create audio when CW is being transmitted is:

   a. WWV.
   b. unmodulated signal.
   c. BFO.
   d. short wave.

10. What is the purpose of station WWV?

    a. music
    b. airplane navigational information
    c. frequency and time signals
    d. F.M.

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LAP TEST: BUILDING SHORT WAVE AND BEAT FREQUENCY OSCILLATORS

1. What is the biggest difference between a standard A.M. radio and a short wave radio?

   a. detector
   b. I.F. AMP
   c. BFO
   d. antenna and oscillator

2. What is the wave length of 3 MHZ?

   a. 100 meters
   b. 1500 meters
   c. 200 meters
   d. 50 meters

3. What does CW stand for in signal characteristics?

   a. continuous wave
   b. code wave
   c. clean amplification
   d. clear wave

4. To what components of a rotary band switch are the wires soldered?

   a. strips
   b. decks
   c. wafers
   d. arms

5. What term expresses the ability of a receiver to select one radio station and reject another?

   a. tuneability
   b. sensitivity
   c. selectivity
   d. detectability

6. When a receiver is aligned for short wave, which component should not be realigned?

   a. the detector
   b. the I.F. AMP
   c. AVC
   d. the BFO

7. The stages which are found in a superheterodyne receiver, but not in a TRF are:

   a. local oscillator, detector and converter.
   b. local oscillator, mixer and I.F. amplifier.
   c. R.F. AMP, detector, and mixer.
   d. converter, detector, and power supply.

8. As the frequency gets higher, the wave length:

   a. gets smaller.
   b. doesn't change.
   c. gets larger.
   d. multiplies.

9. What do the initials "BFO" refer to in a short wave radio?

   a. code for CW
   b. beat-frequency oscillator
   c. before first oscillator
   d. code for WWV

10. What term expresses the ability of a receiver to pick up weak signals?

    a. selectivity
    b. detectability
    c. tuneability
    d. sensitivity